REFERENCE FILE

Spreckels SUGAR BEET Bulletin

VOLUME VI 1942

ISSUED BY SPRECKELS SUGAR COMPANY . . . ESTABLISHED 1897

IN ONE ACRE THERE ARE:

1. 43,560 square feet.
2. 26,136 running feet of row, spaced 20 inches apart.
3. 26,136 beets in rows spaced 20 inches apart and beets thinned to 12 inches (26,136 beets of 1 pound average weight equal 13.0680 tons per acre).
4. 31,363 beets or 15.68 tons of 1-pound beets in 1 acre planted an average of 20 inches apart and thinned 10 inches apart.
5. 39,204 beets or 19.60 tons of 1-pound beets in 1 acre planted an average of 20 inches apart and thinned 8 inches apart.

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Spreckels SUGAR BEET Bulletin

PUBLISHED FOR CALIFORNIA SUGAR BEET GROWERS BY THE SPRECKELS SUGAR COMPANY

VOL. VI JANUARY 1942 No. 1

SEED TREATMENT RECOMENDATIONS

Damping off can be effectively controlled by seed treatment through the proper use of Ceresan.

Apply 1 pound of 2 per cent Ceresan per 100 pounds of seed. For severe infestations, use 1½ pounds of 2 per cent Ceresan per 100 pounds of seed. With the new improved Ceresan, 6 ounces per 100 pounds is sufficient. It is essential to obtain a thorough mixture of Ceresan with the seed.

Treatments should be effected only on daily requirements, because treated seed cannot be stored without risk of injury. Treated seed cannot be returned for credit, and exchanging between growers should not be practiced. After treatment, seed should be planted only under ample moisture conditions.

We recommend that all planting in the Delta be treated, as well as all planting in other areas, prior to March 1. In recommending seed treatment, we recognize that in the past, excellent results have been obtained with untreated seed, but believe treatment with Ceresan is valuable from an insurance standpoint.

For further detailed information, consult your Field Superintendent.

REPAIR NOW!

Shortage of repair parts for farm machinery is imminent. Parts for repair work should be secured immediately. This will not only assure that equipment will be in operating condition, but will permit the Government to arrange for construction of parts without delaying farming operations.

Food is essential in this emergency. We must not be negligent in the performance of our job—food production. REPAIR NOW!

USED SEED BAGS NEEDED

As there will undoubtedly be an acute shortage of burlap in 1942, the West Coast Beet Seed Company, through the beet sugar companies in the United States, is asking growers to return burlap beet seed bags in good condition so they may be re-used for bagging subsequent seed crops.

For bags returned to the Spreckels Sugar Company in good condition a payment of 25¢ each will be made.

It is important that special care be taken of the bags in order that they may be suitable for re-use. They should not be torn, cut, or allowed to be sun-scorched, wet or damaged in any way.

With the full cooperation of all sugar beet growers and sugar beet processors in the United States, we will be able to meet this emergency.

SHEARED SUGAR BEET SEED INVESTIGATIONS

By ROY BAINER, *Associate Agricultural Engineer California Agricultural Experiment Station*

The development of a single germ sugar beet seed ball is the first essential to a mechanized program of sugar beet production. Coupled with this is the necessity of maintaining seed of high germination along with the utilization of planting equipment to give uniform distribution of the seed.

Sugar beet seed balls contain, on the average, more than one germ each. This means that regular seed, when planted, may produce from none to several seedlings per seed ball, making finger thinning imperative in order to obtain a singled stand. A reduction in the number of germs per seed ball will materially reduce the hand labor of thinning. Furthermore, if the beets are to be thinned mechanically, or with a long handled hoe, the percentage of singles would be greatly increased. Any method that gives a higher percentage of single plants will be reflected in a mechanical harvesting system employing ground topping. Beets in multiple combinations seriously affect quality of mechanical topping.

A preliminary machine was built last February for breaking the sugar beet seed ball into segments, each con-

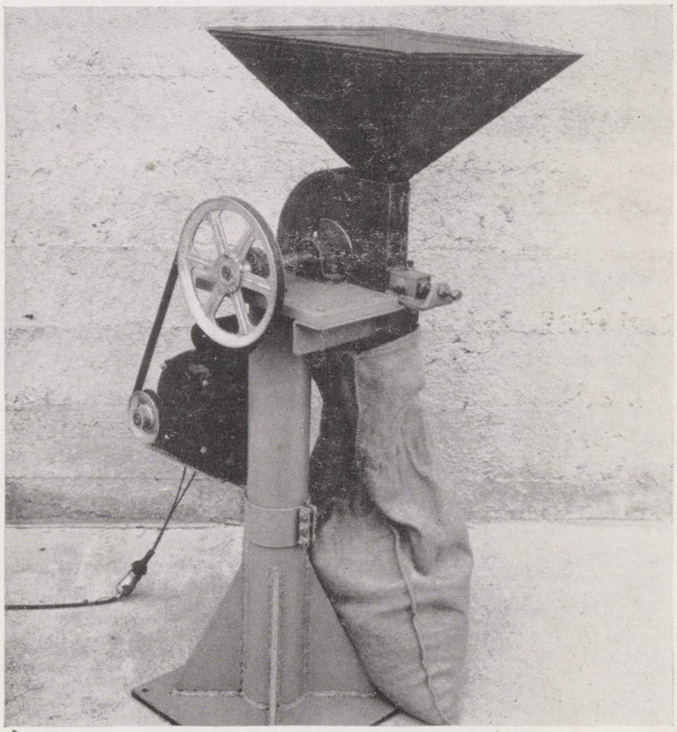

Fig. 1. Experimental sugar beet seed shearing unit. Power is supplied by a ¾-hp. electric motor.

(Continued on page 2)

SHEARED SEED (Continued from page 1)

taining approximately one germ. This preliminary machine consisted of an endless abrasive belt 4″ wide operating over two pulleys. The beet seed was fed onto the belt which in turn carried it under an adjustable steel shear bar located near one of the pulleys. The clearance between the shear bar and belt was approximately 0.080″. The pressure applied to the seed, as it was pulled under the shear bar, broke it along natural cleavage planes between the seed cells. This gave a small flake of corky material enclosing the seed cell and germ, approximately 3/32″ thick and 3/16″ in diameter.

While the preliminary machine gave satisfactory results, the capacity was only 100 pounds (whole) seed per hour, and the life of a belt 20 minutes. In spite of its limitations, several hundred pounds of seed was sheared for experimental plantings.

Later a second machine was built to overcome the defects of the preliminary unit. This second unit makes use of a 20 grit abrasive stone 2″ wide and 10″ in diameter. The principle of operation of this machine is the same as for the original. The stone takes the place of the belt for conveying the seed past the shear bar.

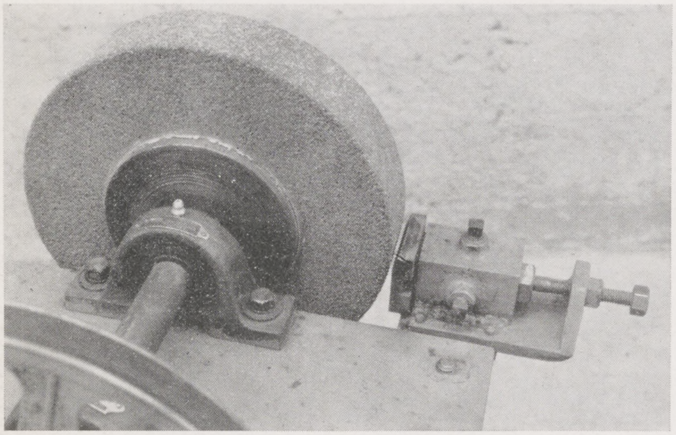

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Fig. 2. Close-up of abrasive wheel and adjustable shear bar.

The present machine, which has an operating width of 1⅞″, has a capacity of approximately 400 pounds (whole) seed per hour when operating at a peripheral speed of 2000 feet per minute.

A Clipper type of fanning mill is used for grading and cleaning the sheared product. An 11/64″ sieve used on top scalps off any large seed that should be rerun, and an 8/64″ screen used below collects the part of the sample to be retained. With the above screen arrangement the maximum variation in size of seed is 3/64″. For some types of seed a 6/64″ screen below the 8/64″ screen saved an increment of seed that could be used. However, more trials must be run in order to be sure of this smaller seed.

During the shearing and cleaning operation the sample of seed is reduced to about one-half of the original weight. However, the sheared sample has approximately twice as many seed segments per unit weight as were in the original sample. For example, one lot of U. S. 15 seed contained 5804 seed balls per hundred grams before shearing and 10,212 units per hundred grams after shearing. (Approximately 46,000 seed units per pound.) Therefore the actual recovery of seed units amounts to 80 to 100 per cent of the number in the original sample.

Germination trials with whole and sheared seed show comparable results. The number of germs per seed ball

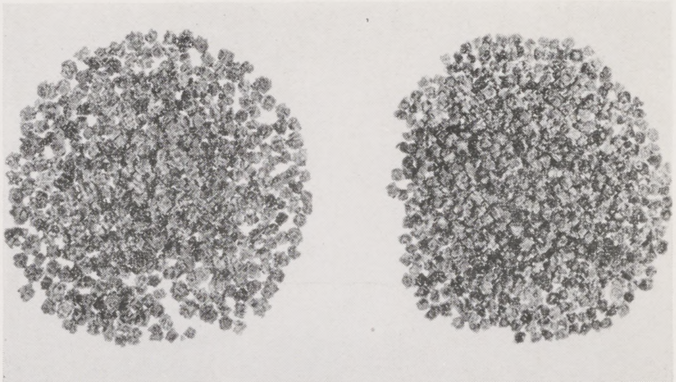

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Fig. 3. The seed shown on the left is from the original sample. That on the right has been sheared.

average slightly over one for the sheared unit as compared to slightly over two for the original sample. This means that sheared seed products only 50 to 60 per cent as many seedlings as are produced by the same number of original seed balls.

Preliminary planting trials of the sheared seed were made with standard planters with special thin (3/32″ thick) plates. These plates were made from standard blanks. Round tapered holes 3/16″ in diameter were drilled near the periphery to give from 55 to 82 cells per plate. Star type knocker wheels were reshaped to fit the new plates. Satisfactory stands were obtained from seeding rates varying from 4.5 to 8 pounds per acre, depending upon the original germination of the seed. One planting at Davis made with 4.55 pounds per acre gave a stand in which 85 per cent of the inches containing beets had singles. Thinning was done entirely with a long handled, triangular shaped hoe having a 4″ blade. The rate of thinning was 1/10 acre per hour. A final stand of 130 beets per hundred feet of row was obtained without any finger thinning.

Some trials have been conducted while others are in progress at the present time to determine the effect of different seed treatments upon germination as well as the controls effected. These trials include1, 1½ and 2 per cent dosages of 2 per cent ceresan; ½ per cent of new improved

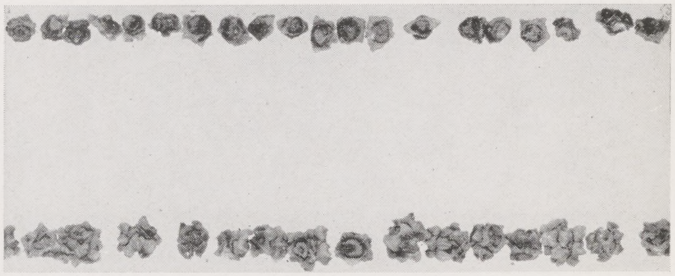

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Fig. 4. Original seed below. Sheared seed above.

ceresan; 3 per cent cuprocide and 1 per cent of spergon. Because of the greater surface area of the sheared seed larger amounts of fungicides may be necessary to protect against "damping off" due to such organisms as pythium and rhizoctonia. From preliminary seed treatment investigations, it appears that the sheared seed is no more susceptible to injury from seed treatment than whole seed. On the other hand, seed treatment seems to be more necessary for protection of sheared seed planted under infected soil conditions.

FOOD WILL WIN THE WAR AND WRITE THE PEACE

More sugar production is urged by Secretary of Agriculture Wickard in an official leaflet published by the Department of Agriculture entitled "Your Farm Can Help."

"Food to feed our people properly. Food for the democracies fighting freedom's battle. Food for Europe's starving millions when the war is over. Not just any kind of food, but the concentrated, highly nutritious foods that ship easily, store easily."

The Secretary continues: "The American farmer is called upon to engage in the most stupendous farm production in the history of the United States.

"It won't require more total acres than are now in cultivation. It won't require more production of many things—even less of some. But it will call for a great deal more milk. It will call for more eggs, pork, certain fats and oils, tomatoes and some other vegetables, cover crops, lumber, turpentine, sugar."

Also included in the list of foods needed in greater quantities are lamb and mutton and larger slaughter of beef.

Sugar beet production not only provides the sugar required, but provides livestock food, of which we have no abundance in California, for cattle and sheep.

Fear of labor shortage may have some influence on the quantity of sugar produced. A program is being started now in an effort to arrange for satisfactory labor. Cross blocking has been used sufficiently to demonstrate that it is entirely feasible if labor for thinning is not available.

The production of various types of machines for mechanical harvesting is being vigorously pushed. It is fully expected that some of each will be in commercial production next year. It cannot be promised that these machines will harvest any large portion of the California acreage, but it is hoped that they may do a sufficient volume of work to relieve some of the pressure which may exist.

LABOR FOR 1942

By G. P. WRIGHT, *District Manager*
Sacramento Office, Spreckels Sugar Company

There has been a definite shortage of field labor during the harvest season. This shortage has been caused by the great demand for men in all types of defense work and the demands upon all industry and agriculture incidental to the National Defense Program.

A surprisingly large number of Mexican and Filipino field workers have moved into other employment. This movement of field workers to semi-skilled jobs has been caused by the movement of large numbers of semi-skilled workers into skilled defense work or into the Army or Navy. Mexican and Filipino field workers are now finding employment in railroad shops, shipyards and all other types of industry. These jobs have naturally attracted the better type of field labor.

The entire sugar beet growing area of California must face this labor situation. In addition the area is being requested by the Government to increase the production of all farm crops, both for animal and human consumption. The sugar beet grower is a producer of essential food, both for human and animal consumption, therefore he has a double responsibility.

Growers now realize that regardless of the type of crop grown, there will be some difficulty in securing sufficient field labor to grow and harvest the crop. The grower should, therefore, get his house in order so that his field work and those items incidental to his field work are most attractive to labor.

There are a number of means of making field work more attractive. A large grower can rather easily space his plantings so that his thinning does not all come at the same time. All growers can make more carefully prepared seed beds and secure a satisfactory stand of beets with less seed per acre. All growers can do a more thorough job of cultivation, which will increase the speed of thinning and make more comfortable working conditions for the field laborers. After securing a satisfactory stand of beets most growers can assist their field labor and speed up their work by cross cultivation of their crop. There has been sufficient experimental and actual field cross cultivating done to prove beyond question that this type of work does not reduce yields. All of the items mentioned will assist the field labor to do more or better work. None of them means extra work for the grower. They are all well in line with proper farming procedure.

The most serious drawback to a satisfactory labor setup during times of labor shortage is the shortage of proper housing facilities for a field labor crew. There are a few excellent labor camps scattered throughout the beet growing area. Because of the scarcity of good camps, however, they are over-populated and too many growers are dependent upon field labor from these few camps. Under present labor conditions, these camps cannot possibly supply labor for large acreages. Therefore, the large grower must make arrangements to house his labor properly and small growers must group together and provide adequate housing for their labor.

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Contrast in labor housing.

The cost of a properly constructed labor camp is not a financial burden on the land. It is, rather, a most necessary improvement which enhances the value of the property and can be of use if crops requiring large numbers of laborers are not grown.

In other parts of the state, where intensively farmed crops are grown, the labor situation has been improved by building family camps. These small family units are inexpensive to build and attract a more permanent group of people than the large camps where only single men can be housed.

PREPARE HOUSING BEFORE THINNING TIME

Thinning of beets will not start for three months. Now is the time for all growers to make adequate and satisfactory arrangements for properly housing their field labor. The local field superintendent and the labor superintendent can be of assistance to all growers in advising with them regarding size and construction of camp or perhaps the reconstruction of some present building which can be cheaply rebuilt into a labor camp. The total cost of a proper labor camp can quickly and easily be lost to the grower by a thinning job done three weeks late or a harvest job which has been delayed because of a shortage of labor.

DISEASE AND BOLTING RESISTANCE IN VARIETIES

By J. E. COKE, *General Agriculturist*
Spreckels Sugar Company

Everyone in the beet sugar industry today is aware of the excellent work of the United States Department of Agriculture in developing sugar beet varieties. As the varieties are developed, they are subjected to many careful adaptation tests over a period of years to determine their characteristics.

There is as yet no single variety which can be planted under all conditions if maximum yields are to be obtained. Essential in determining the variety best adapted for a particular planting is accurate information on bolting, mildew, and Curly Top resistance. Therefore, data from a few typical adaptation tests are given below.

CURLY TOP

Date Planted	Location of Plot	Variety: Old Type	U. S. 15	U. S. 33	U. S. 22	U. S. 23
		Percentage of Plants with Curly Top				
Dec. 1939	King City	8.00	7.00	2.00		
Feb. 1941	King City	4.44	6.11	1.67	0	0.33
Mar. 1940	King City	59.00	55.00	26.00	12.00	12.00
Mar. 1940	Vernalis	89.00	97.00	50.00	13.00	15.00

Because Curly Top disease has not been widespread or serious in California during the past few years, readings on resistance to this disease in tests conducted by the Spreckels Sugar Company have been few. However, the results from these few California tests are substantially the same as readings secured from certain tests conducted in the intermountain states, where the disease has been serious. It will be noted from the data presented that if planted early, even the non-resistant Old Type and the slightly resistant U. S. 15 are only slightly affected with Curly Top.

Under mild Curly Top infestation, U. S. 15 is superior to the European variety. On the other hand, if mid-season or late planting is necessary, it is entirely unsafe to use these varieties except in districts free from Eutettix infestation.

The most resistant strain so far developed and in commercial use is U. S. 22. This variety is particularly well adapted for late planting in areas heavily infested with Eutettix.

U. S. 23 is almost as resistant as U. S. 22.

U. S. 12, although not listed in the tabulation, lies somewhere between U. S. 33 and U. S. 22 in resistance.

With the usual amount of Curly Top prevalent in California, U. S. 33 has sufficient resistance so that it has proven an excellent variety for mid-season planting.

BOLTING

Date Planted	Location of Plot	Variety: Old Type	U. S. 15	U. S. 33
		Percentage of Plants Which Bolted		
Dec. 1940	Banta Carbona	27.88	4.11	56.11
Feb. 1940	King City	0.44	0	0.89
Dec. 1939	King City	8.00	1.00	17.00
Jan. 1940	Salinas	6.00	0	22.00
Dec. 1939	Vernalis	33.90	3.70	53.00
Dec. 1939	Woodland	30.00	3.00	49.00

No variety now available is as resistant to bolting as U. S. 15. Therefore, it can be planted earlier than other strains. Old Type is second in resistance to bolting and, therefore, should be planted at a later date than U. S. 15. The other varieties which are planted in midseason or late need not be considered from the standpoint of bolting, because there is generally little or no seed stalk formation when planted during this portion of the year.

MILDEW

Date Planted	Location of Plot	Variety: Old Type	U. S. 15	U. S. 33	U. S. 22	U. S. 23
		Percentage of Plants with Mildew				
Dec. 1940	Banta Carbona	8.33	8.11	9.00		
Feb. 1941	King City	48.6	33.3	50.00	59.4	43.7
Mar. 1941	King City	8.22	4.22	8.44	10.44	
Dec. 1939	King City	39.00	31.00	43.00		
Mar. 1940	King City	37.00	24.00	36.00	46.00	34.00
Mar. 1940	Vernalis	3.00	5.00	10.00	12.00	10.00

In resistance to mildew, U. S. 15 usually out-performs other varieties, with Old Type a close second. There is little choice between the remainder of the varieties in their resistance to this disease.

Considerable work is in progress in the development of increased mildew resistance in U. S. 15 and U. S. 33 and it is expected that the resistance in at least U. S. 33 can be materially increased.

SUMMARY

For December and January planting, U. S. 15 should have first preference, with Old Type second, because of bolting resistance and mildew resistance.

For mid-season planting, U. S. 33 and U. S. 12 are well adapted because of increased Curly Top resistance.

For late planting, U. S. 23 and U. S. 22 are suitable because of their very high resistance to Curly Top.

BEET HARVESTING MACHINE DEMONSTRATED

A meeting was held at Davis, California, by the Division of Agricultural Engineering of the University of California on November 24 to demonstrate the beet harvesting machine developed by that institution. The meeting was attended by growers from most sections of northern California.

The harvesting machine consists of a single row variable cut topper, swung under a row-crop tractor, a beet plow and a lifter which throws the beets free of clods and dirt into a position where the beets can be caught on an elevator for loading onto tractors or windrows.

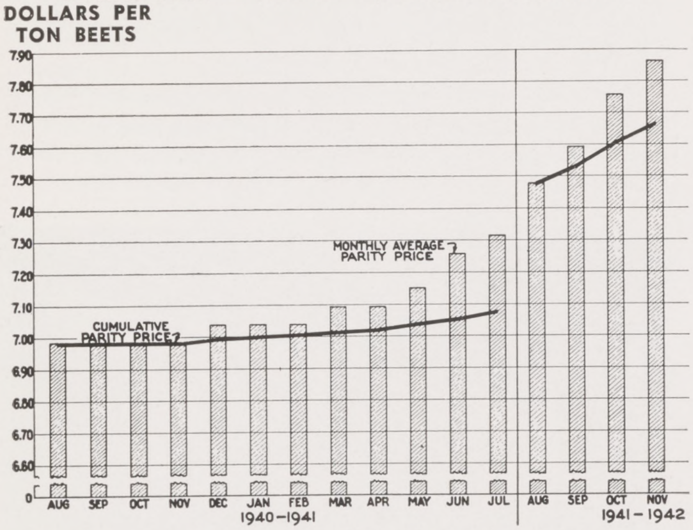
This project of the Division of Agricultural Engineering to mechanize the beet production phases of the beet sugar industry was greatly accelerated three and a half years ago when the United States Beet Sugar Association contributed a considerable sum to the project.

Ten beet topping units have already been built and it is expected that by the next harvest season, this project will have made considerable headway.

Beet harvesting machinery demonstration at Davis proves interesting to growers.

NOVEMBER PARITY PRICE OF SUGAR BEETS — $7.87

(PARITY BASE — 1909-14 = $5.50 PER TON BEETS)



CONSERVATION OF MANURE ON THE FARM

By R. D. JONES *and* H. J. VENNING, JR.

Agricultural Department, Spreckels Sugar Company

Conservation of the potential fertilizer and humus values of manure derived from the feeding of livestock on the farm has not been given the attention by California farmers that its value warrants. The perishable character of manure is not generally appreciated. A review of various informative sources shows that losses range from 15 to 80 per cent depending on the method of handling the manure.

Livestock manure is nature's most complete fertilizer. On the average, allowing for the type of animal producing manure and the composition of feeds, a ton of fresh farm manure contains approximately 10 pounds nitrogen, 5 pounds phosphoric acid and 10 pounds potash. This ratio of 10-5-10 holds relatively true for all types of animal manure. Horse and cattle manures contain approximately the same amount of these elements. Sheep manure maintains about the same ratio but contains about 30 per cent more of these elements per ton.

The following table gives the daily amount and composition of solid and liquid excrement voided by mature animals.

A study of this table reveals that the liquid excrement is much richer in nitrogen and potash than the solid excrement; however, the solid excrement contains relatively larger amounts of phosphoric acid. Generally speaking, the major loss in handling manure is the loss of the fertilizer elements contained in the liquid portion of the excrement. To save and conserve these valuable elements requires the use of litter, bedding or other materials which have the ability to absorb urine.

Table II shows various kinds of litter and the average amount required to absorb 100 pounds of liquid and the nitrogen fixing capacity per ton of litter.

TABLE II
CHARACTERISTICS OF LITTER MATERIALS
(In *Pounds*)

Material	Litter Required to Absorb 100 Lbs. of Liquid	Nitrogen Held Per Ton of Litter	Content of Fertilizing Ingredients Per Ton of Air-Dry Manure and Litter: Nitrogen	Phosphoric Acid	Potash
Straw—unchopped	35-45	3.4-7.1	11-12	4-6	17-26
Straw—chopped*	20-30	....	....	....	....
Peat moss** (Sphagnum)	10	40	16	2	3

*Chopping of straw for bedding purposes is not considered economically practical at usual prices.

**Peat moss to be used as bedding in experiments at the J. G Bell and Henry Gasser feed yards near Woodland this fall.

Reference: U.S.D.A. Yearbook—1938—Page 451.

This table shows the relative value as an absorbent of various litter materials. The importance of litter or bedding cannot be overlooked. Other important factors in its use are:

1. To increase the amount of slowly fermentable matter in manure in order to check and control decomposition.
2. To increase the amount of organic matter and plant food.
3. To retain or fix ammonia and prevent its escape into the air.
4. To make manure easier to handle.
5. To provide additional humus.

(Continued on page 6)

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Fig. 1. Value of manure in this corral would have been greatly increased if it had been periodically placed in large piles.

TABLE I
AVERAGE DAILY AMOUNT OF SOLID AND LIQUID EXCREMENT OF MATURE FARM ANIMALS

	Daily Production Per Animal		Composition of the Fresh Excrement									
			Dry Matter		Nitrogen		Prosphoric Acid		Potash		Lime	
	Solid Lbs.	Liquid Lbs.	Solid	Liquid	Solid	Liquid	Solid	Liquid	Solid	Liquid	Solid	Liquid
			Percentage									
Horses	35.5	8.0	24.3	9.9	0.50	1.20	0.30	Trace	0.24	1.50	0.15	0.45
Cattle	52.0	20.0	16.2	6.2	.32	.95	.21	0.03	.16	.95	.34	.01
Sheep	2.5	1.5	34.5	12.8	.65	1.68	.46	.03	.23	2.10	.46	.16
Hogs	6.0	3.5	18.0	3.3	.60	.30	.46	.12	.44	1.00	.09	.00

Source: United States Department of Agricultural Yearbook—1938. Page 450.

CONSERVATION OF MANURE *(Continued from page 5)*

Table III, besides showing total manure production figures, excrement plus bedding, illustrates how large a part of the constituents of manure are water soluble and readily subject to loss by leaching, drainage, etc.:

TABLE III

POUNDS OF MANURE, INCLUDING LITTER* OBTAINED PER YEAR PER 1,000 POUNDS LIVEWEIGHT BY FARM ANIMALS, AND POUNDS OF ASH, ORGANIC MATTER AND PLANT FOOD CONTAINED IN MANURE

		Horse	Steer	Sheep
			In Pounds	
Manure per 1,000 pounds liveweight		13,080.00	15,700.00	12,100.00
Moisture		7,738.10	12,222.50	7,696.80
	Total	693.20	494.80	601.40
Ash	Water soluble	277.30	224.50	299.20
	Total	4,321.60	2,968.90	3,718.30
Organic matter	Water soluble	201.40	208.80	240.50
	Total	14.13	32.66	26.98
Phosphorus	Water soluble	7.46	11.68	15.73
	Total	83.19	72.06	122.21
Potassium	Water soluble	62.78	66.58	118.10
	Total	90.90	113.10	174.10
Nitrogen	Water soluble	47.74	63.43	73.21
Average weight of animal		1,100.00	1,302.00	84.00

*Straw—amount used per animal per day: Steers, 7-10 lbs.; horse, 10-15 lbs.; sheep, 1 lb.

Reference: John Deere Co.—Experimental Farm.

The principal cause of losses occurring in the handling and management of manure are:

1. Failure to save the liquid portion of the excrement through insufficient use of litter.
2. Lack of understanding on how to control the fermentation and decomposition processes to avoid oxidation, with the resultant destruction of humus and liberation of free nitrogen.
3. Lack of understanding of the necessity to provide simple storage facilities by which the losses occasioned by seepage, drainage and exposure could be curtailed and prevented.
4. Failure to scrape corrals or open feed lots periodically to prevent loss of ammonia nitrogen by air drying, exposure to wind and untimely rain.

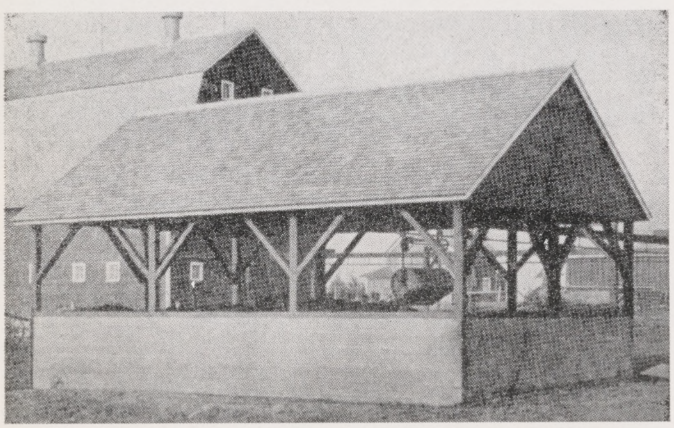

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Fig. 2. Value of manure as a farm by-product is not generally appreciated. Covered buildings in which manure can be periodically deposited pay large dividends. With this type of storage, the mass compacts, air is excluded, preventing to a large degree losses from decomposition and leaching.

The prevention of all losses is not possible, but certain definite practices can be employed to minimize them. It is generally conceded by many investigators that daily spreading of manure followed by early disking or plowing under, is the most efficient means of conserving manure values. This practice is limited by the type of cropping, condition of fields or available labor.

When immediate and continuous spreading is not practical it then becomes necessary to consider some method of storing to prevent loss until such a time that crops have been harvested and land is available for spreading.

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Fig. 3. At least 50 per cent of the value of manure is lost when it is stored in the open and is subject to leaching.

Stable, feed lot and dairy barn manures in most cases are removed by wheelbarrow or hand cart to some not too distant spot and are usually dumped where they are subjected to every adverse condition. It is feasible and practical to construct a retaining pit of concrete, redwood planking or even a dirt pit with a roof of sufficient height to permit working inside. This will not require more labor in handling and the cost of building pit and roof will soon be repaid in conserved manure values. When this type of storage is provided, the mass becomes compacted, air is excluded, preventing to a large degree losses through decomposition. Definite and conclusive data are available from numerous sources showing that fully 50 per cent and more of manure values are lost when no storage facilities are provided.

On many California farms, a large part of manure production occurs in corrals adjacent to the barns and in open feeding lots. Conservation of manure in these circumstances can be taken care of by systematic and periodic scraping of the manure and depositing in large piles or mounds. Some loss under these conditions is unavoidable. However, by piling and compacting by the use of stock, much of the loss can be minimized and values thereby conserved until land is available for spreading.

In conclusion, it can be definitely stated that manure is a valuable product of the farm feeding livestock and the farmer cannot afford to waste its values because manure can be an important factor in increasing net farm income. As one prominent farmer-feeder so ably stated, "I never made a great amount of money feeding livestock, but I never made any money farming until I fed livestock."

TILLAGE MODIFIES SOIL STRUCTURE

By HUGH F. MELVIN, *Agricultural Superintendent*
Spreckels Sugar Company

Seed beds may be prepared properly in many different ways. Soils vary so greatly that no definite rule or farming practice can be set up as the only proper procedure to follow. The important thing is a satisfactory seed bed.

The primary accomplishment of tillage is the modification of the soil structure. The soil is tilled in this preparatory work so that its relative structural changes may be improved for crop growth. Farmers should acquire a good knowledge of soils so that they can determine the conditions and the changes that should be effected and the type of implement to be used in accomplishing the desired results.

In general, land preparations can be divided into two groups—those that loosen the soil and those that compact the soil structure. These results may be obtained in various ways.

Rather often, beet growers are required to overcome some unusual condition with few tillage implements, and of necessity they should be practical and resourceful in their judgment of conditions.

In preparing for sugar beets, the fall is generally considered the best time for the deep tillage operations, or at least before heavy rains have penetrated deeply into the soil. We all know that excessively wet land must not be plowed. A practical rule to follow is—that if the soil is moist enough to mold in the hand, yet crumble when dropped, it is just right. Discing before plowing to cover the trash is an excellent practice.

Conditions may arise whereby fall plowing would be impossible. Very good results have been obtained by doing this work in the spring. However, after a wet fall, good drainage is an important aid to spring plowing.

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Soil is tilled in preparation for crop so that its structure may be improved for crop growth.

The texture of the soil governs the type and amount of work necessary to obtain a desirable granular condition, so that there will be a contact between the soil worked and the sub-soil. The seed bed should be *deep, fine, level* and *firm*. The work should be done with the idea of retaining sufficient moisture to care for the young plants until more water can be added.

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A land plane smooths surface soil irregularities so that subsequent cultural operations can be more efficiently carried on.

EXPERIMENTING ON THE FARM

By HARRY J. VENNING, JR., *Assistant Field Superintendent*
Spreckels Sugar Company

The Spreckels Sugar Company has each year carried on an intensive experimental program by which it has attempted to determine methods of securing higher yields of sugar per acre. This work has been done in the following phases of sugar beet operations: Planting, thinning, cultivation, variety testing, irrigation, etc. These various trials have been conducted in what were considered representative areas in order to be applicable to a considerable area of beet land adjacent to the trials. However, in observing results of experiments such as these, it must be borne in mind that this is what has occurred on a particular piece of land in a particular year. For this reason, it is of great value to the individual grower to carry on a simplified form of this work on his own ranch.

A simplified experiment can be carried on within the farm program without a great deal of additional work from the grower. The randomized type of plot used by the Spreckels Sugar Company in its experimental program is too complicated and troublesome for the average farmer but by selecting a uniform piece of ground for the trial, this plot method may be eliminated. If the selected piece is known to be uniform as to fertility and soil structure, it is then possible to use the strip planting method.

In laying out any experimental plot, it should be done in 16 or 32 row units in order to facilitate a simple method of obtaining harvest records. These units assure a lack of errors on the part of the topping and loading labor in the field. Truck drive units such as these also afford a convenient method of measuring areas which are being checked, thus eliminating the necessity of sending short loads to the dump. If the field is of sufficient size, it is a good practice to put in at least 3 check strips, spread across the field. The one important thing to keep in mind in laying out this system, is the units in which the original work is being done.

By having the truck driver indicate to the scaleman when experimental loads are brought to the dump, it is possible to have the scale beam ticket serve as a yield record when marked with identifying letters by the scaleman.

Each grower has his own individual problems, peculiar to the land he is farming. For this reason it is difficult to

(Continued on page 8)

EXPERIMENTING ON FARM (Continued from page 7)

say here just what type of work should be carried on. A few of the more common trials include the following:

I. *Fertilization:*
   - a. Using various rates of application.
   - b. Using various types to determine requirements of the land.
     1. Commercial vs. manure.
   - c. Using different dates of application.
   - d. Using different depths of placement.

II. *Cover Crops:*
   - a. Using cover crop vs. no cover crop.
   - b. Using different types of seed.
     1. Austrian winter peas, vetch, bur-clover, fenugreek, sweet-clover, etc.
   - c. Using different methods of working into the soil.

III. *Rates of Seeding:*
   - a. Using various rates of seeding with single drop plates.

IV. *Cross-Cultivation vs. Regular Thinning:*
   1. Requires good stand for this work.

V. *Dates of Planting:*
   1. Staggered dates of planting will be advantageous next year because of the labor situation.

VI. *Ridge Planting:*
   - a. Bed vs. flat planting.

VII. *Irrigation:*
   - a. Using various amounts and number of applications.

VIII. *Land Preparation:*
   - a. Using various depths of plowing, etc.

The grower, in attempting trials such as these, should be cautioned about giving the work enough supervision that he can rely on his results and not come to an erroneous conclusion. It is essential that an adequate system of checks is established. The Spreckels Sugar Company is anxious to see the individual growers increase their net farm gain by the proper farming of their particular land and is willing to assist any interested growers in laying out plans for an experimental trial.

SHEARED SEED TRIALS PLANNED

By J. E. COKE, *General Agriculturist*
Spreckels Sugar Company

The use of sheared seed, discussed by Professor Roy Bainer in his article on page 1, offers the best means so far developed of reducing labor requirements for thinning. The method of shearing seed was developed only this year and there is, therefore, insufficient field experience to recommend its wide use. Sheared seed will be of real value if it is found possible to plant at very light rates of seeding with drills which will space each seed unit so that no stoop labor is required for thinning.

It has generally been conceded that the use of large quantities of seed makes more certain the securing of satisfactory stands of beets. If further field experience indicates that heavy rates of seeding are necessary to obtain adequate stands, then the solution of the labor problems connected with thinning will probably not lie in the field of sheared seed. However, such experience as has been obtained with sheared seed and the greater volume of experience obtained with single seed planting of regular seed indicate that under most conditions satisfactory thinned stands can be obtained with relatively light rates of seeding, providing the seed is planted uniformly in the row.

It is possible that the use of the variable depth principle of planting will be of great assistance in securing satisfactory stands with sheared seed planted at very light rates. The variable depth principle provides for planting seed to a depth from approximately 1½″ to almost surface level within a distance of about 10″. With this wide variation in depth of planting, seed from some depth would germinate and emerge almost regardless of the type of weather condition that prevailed following planting. If good weather conditions prevail, then all the seed may emerge, although there may be some lag in the date of emergence of the deeper planted seed.

While equipment has been developed for variable depth of planting and uniform distribution of the sheared seed in the row, there has not yet been sufficient time to gain much field experience. The Spreckels Sugar Company, therefore, plans this year to ask a large number of growers to cooperate in establishing tests under a wide variety of conditions so that as much experience as possible can be gained this year. It is planned to have drills equipped for single seed planting of sheared seed, some of which will plant at variable depths and others, at uniform depths. These drills will be taken to fields that are being planted. A small area in the field will be seeded with this equipment so that it may be checked against the regular planting in the field.

Sheared seed will be available for growers desiring to experiment with it this season. It is advisable that those who wish a supply of this seed make their requests to their field men as early as possible so that the seed can be sheared and be available for use.

WEATHER BULLETINS DISCONTINUED

The War Department has asked the Krick Industrial Weather Service to discontinue all activities wherein weather forecasts are distributed to the general public. For this reason, it will, of course, be impossible for the Spreckels Sugar Company to continue to provide you with the monthly weather bulletins. We regret this exceedingly, but for the present emergency there is no alternative.

The Krick Weather Service reports that a method may be worked out whereby individuals desiring to subscribe to its weather bulletins may do so under a controlled plan, in which each bulletin will be numbered so that it might be traced if desired. Those interested in such a service should contact the Krick Industrial Weather Service, 25 North Mentor Avenue, Pasadena, California.

We are hopeful that at the cessation of the present emergency we may again resume the service of sending these weather forecasts to you.

Spreckels SUGAR BEET Bulletin

PUBLISHED FOR CALIFORNIA SUGAR BEET GROWERS BY THE SPRECKELS SUGAR COMPANY

VOL. VI FEBRUARY 1942 No. 2

CROSS BLOCKING—A NEW APPROACH

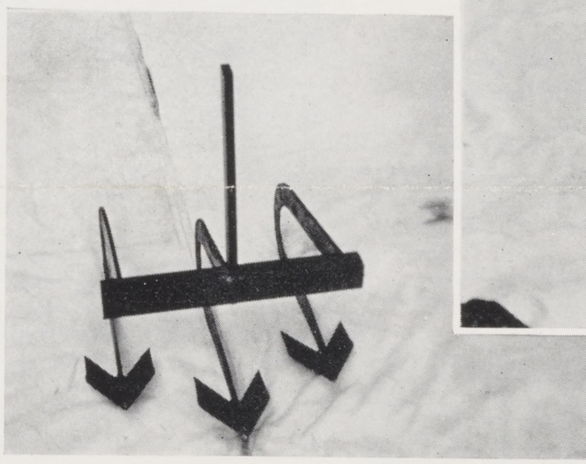
By J. E. COKE, *General Agriculturist*
Spreckels Sugar Company

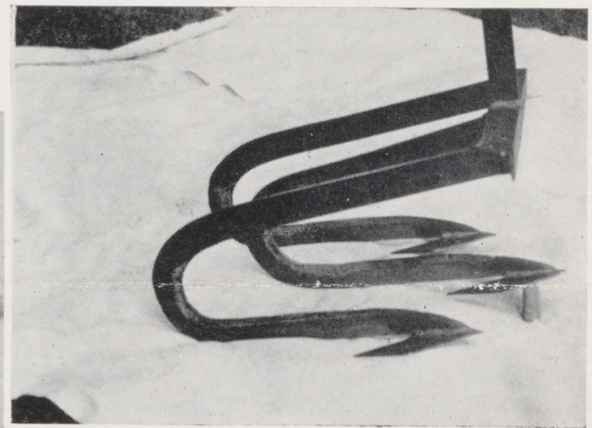
A new approach to cross-blocking of sugar beets has been developed by the Great Western Sugar Company of Denver, Colorado.

Great Western Sugar Company recognized the time required and the difficulty of accurately setting regular cultivating tools on the cultivator for cross-blocking and, therefore, developed gangs of cross-blocking tools for this work. By the use of these gangs it is possible quickly and accurately to prepare a cultivator for cross-blocking.

It will be noted in the accompanying illustrations that the shank of the duck feet has been sharpened to aid with trash clearance and that the duck feet in the gang are not parallel. This reduces the difficulty through the clogging of the duck feet.

Another important development made possible by the use of this type of gang, which may prove of value under California conditions, is the spacings of the duck feet. The duck feet in the gang illustrated are 4 inches wide and are spaced to leave a block 2 inches wide. Thus, in each 12 inches of row, two blocks 2 inches wide are left. Under some California conditions, it might be desirable to cut 3 inches and leave 2-inch blocks, so that two 2-inch blocks are left for each 10 inches of row.





Duck feet built in gangs for cross-blocking. The duck feet are 4 inches wide and set to leave a 2-inch block.
Photographs—Courtesy Great Western Sugar Company

After cross-blocking with this equipment, the thinning operation can be completed by the use of a long-handled hoe, cutting out all the blocks necessary to provide an average of a 10-inch spacing.

The advantage of this system of cross-blocking over our normal cross-blocking (wherein a 7-inch cut is made, leaving a 3-inch block) is that in the final thinning there are more blocks left from which to make selections. Also, the blocks which are left are smaller in size, thus providing more blocks which have been reduced sufficiently in number of beets so as to require no additional hoeing.

BLIND TILLAGE FOR WEED CONTROL

By W. W. ROBBINS, *College of Agriculture*
University of California, Davis

The tillage of the soil after seeding a crop, either before the crop plants are up or while they are in the very early stages of growth, is known as *blind tillage*. It is a method extensively employed to combat weeds in both row crops and in cereals.

There are special types of movable jointed harrows with very closely set tines which have widespread use in Europe, and to a lesser extent in this country. It has been stated by European agriculturists that the introduction of such harrows represents one of the most important advances in weed control within the past decade. Thus far, greatest use of blind tillage has been in small grain. Tillage, using various types of harrows, is done as soon as weeds appear, even though seedlings of crop plants are not above the ground, and repeated as may be necessary until the plants are well advanced. A worker in Sweden has shown that one harrowing to control weeds in cereals resulted in an average increase of about 8 per cent in grain yield as compared with no treatment. A second harrowing gave an additional increase of about 3 per cent. In case the original stand of cereals is sparse, or the crop is too far advanced, harrowing may result in a noticeable decrease in yield.

In the Columbia River basin wild mustard in fall-sown wheat is successfully combatted by repeated harrowing in the spring.

The rotary-hoe and the spike-tooth harrow have been employed with success in the control of weeds in young corn, cotton, and other row crops. The first cultivation is usually about two weeks after seeding whether the crop is up or not. This cultivation in most cases is a harrowing across the rows. A sugar beet planting will withstand this treatment, and in many instances benefit by it as a result of the elimination of the weed competition.

Blind cultivation as a means of combatting soil crust has long been practiced by beet growers. Usually this involves cultivating with the row before the seedlings come through the soil; then a roller is generally used to break the crust immediately over the row. This system is used after the seed has germinated and the seedlings are close to the surface. It requires a skillful operator because the rows are evident only by the press-wheel marks, and if the knives are not properly adjusted a reduction of stand will result.

DETERMINATION OF PRETHINNED STAND NECESSARY FOR CROSS BLOCKING

By HARRY J. VENNING, JR., *Agricultural Department Spreckels Sugar Company*

It is a recognized fact that when a beet grower is considering cross-blocking, his first question is: What kind of a seedling stand do I need and what kind of a seedling stand do I have? The seedling stand combined with the mechanical cross-blocking setup determines the final thinned stand or number of beets per acre, which is the grower's main consideration.

With the thought of cross-blocking in mind, it is necessary for the beet grower to make a survey of the average pre-thinning stand conditions throughout the field. One method used for determining distribution of the stand is by seedling counts made with the use of a 100-inch measuring stick. Any rod or stick marked with one-inch intervals will serve the purpose. Hinging the stick at the 50-inch mark serves for ease in operation.

The stick is placed beside the beet row in a section considered to be representative of the field. The first step is to count the total number of seedlings within the 100-

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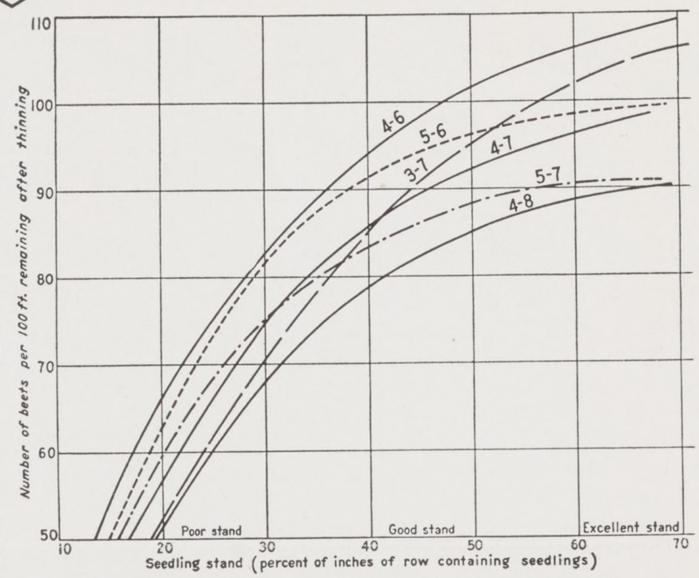
An accurate estimate of the pre-thinning stand of beets is necessary to determine proper spacing for cross-cultivation. Photograph—courtesy Division of Agricultural Engineering, University of California, Davis.

inch space selected. Making counts when the beets are still small will speed up the counting to a great extent. The next count to be made is of the number of inch spaces having only single beets. Then count the number of spaces with no beets growing opposite them. By adding the number of spaces with singles to the number of spaces with no beets and subtracting from 100, we will have the number of spaces with more than singles. Taking a series of these counts throughout the field will then give a numerical picture of the seedling stand for the field.

The chart shown below, taken from the United States Department of Agriculture Circular No. 316, page 5, is used for determining the proper spacing of tools on the cultivator for cross-blocking sugar beets when the stand of seedlings is known.

To illustrate the use of this chart, suppose there are 50 inches per 100 inches of row in which there are beets. Find



From predetermined seedling stands it is possible to determine by the use of the above graph the number of beets remaining after thinning with various spacings used in cross-cultivating.

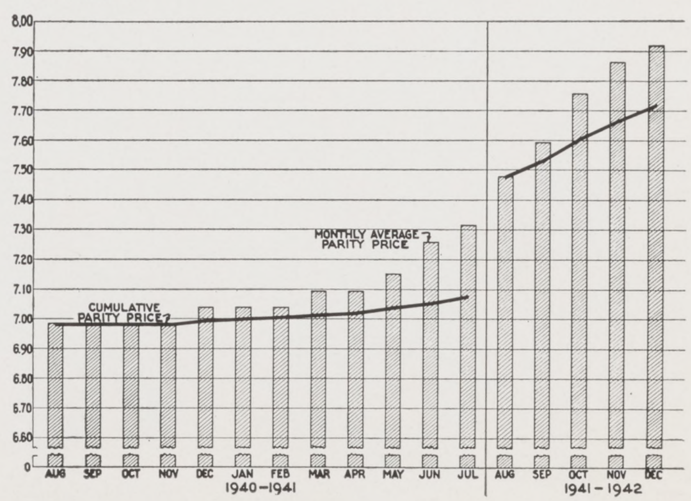
the line marked 50 at the bottom of the chart and follow it to its intersection with the curve marked 4-8. At the left of the chart opposite this point it will be noted that the final stand of beets after thinning will be 85 beets per 100 feet of row. This means that with the knives set so as to leave a 4-inch block and cut out 8 inches, beets would be left in 85 per cent of the blocks. With the same stand of beets before thinning, a 4-7 combination would produce a stand of 93 per cent. The final stand of beets as indicated on the left of the chart takes into consideration not only the probability of the mechanical blocker cutting out an occasional block of beets but also allows for beets lost in the thinning operation.

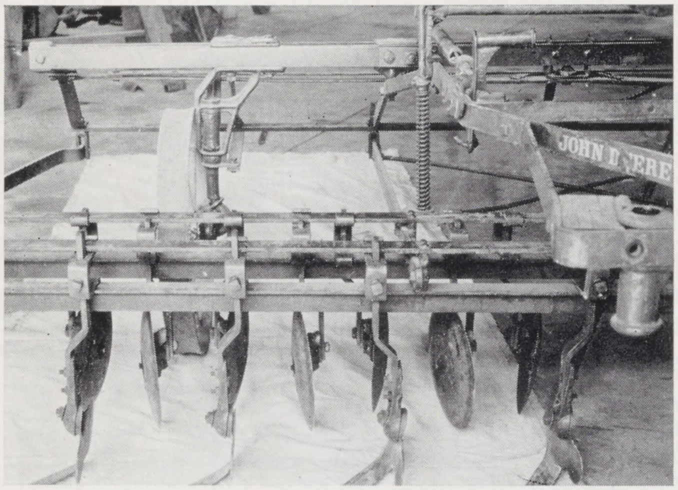
The grower should be thoroughly familiar with the seedling stand in his field before attempting any mechanical reduction in stand. Cross-blocking is not an operation to be performed on a mediocre stand but should be attempted only when a superior seedling stand is obtained.

DECEMBER PARITY PRICE OF SUGAR BEETS — $7.92

(PARITY BASE — 1909-14 = $5.50 PER TON BEETS)

DOLLARS PER TON BEETS





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Discs and weeder knives set on cultivator for cross-blocking.
Photograph—courtesy Division of Agricultural Engineering, University of California, Davis.

GROWERS' EXPERIENCES WITH CROSS BLOCKING POINT WAY TO LABOR SOLUTION

By W. R. LIDER, *Agricultural Department Spreckels Sugar Company*

This is a summary of the experiences of several beet growers in the Woodland-Davis-Dixon area who have used various means of cross-blocking and long-handled hoe thinning to secure satisfactory stands of thinned beets. In all, there are five growers concerned. Number one has used this method for the past three years and the results have been very gratifying. It is a standard practice in his operations. Grower number two used this means of thinning his beets this year on his entire acreage. Grower number three has planted a light rate of seeding the past two seasons and then thinned with long-handled hoes. Growers four and five both used cross-blocking and long-handled thinning as an emergency measure to save their beets this past spring when labor was not available to thin them in the usual manner.

It must be admitted that in all of these cases there are no scientific checks to prove that cross-blocking or long-handled hoe thinning gave better yields than regular thinning. The point is that these growers used these methods of handling their thinning operation satisfactorily and obtained yields that were commercially acceptable.

Grower number one practices are as follows: Prior to the first cultivation he sets his cultivator tools on his bar to the same spacing used in cultivating standard 20-inch center drill rows. He uses only his knives or sweeps. This leaves a space approximately three inches wide where his row would be and a space approximately three inches wide in the center of the rows where the knives do not cut. The cultivators are then pulled crosswise of the rows. This leaves blocks approximately three inches wide on ten-inch centers. A few days after this cultivation the beets are cultivated in the normal manner.

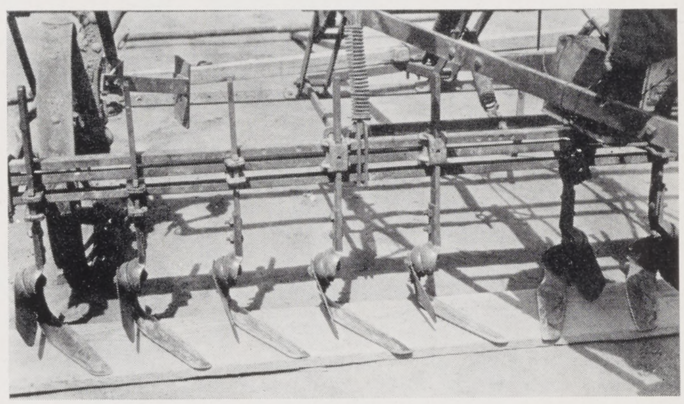
When the plants are at a normal thinning stage the thinning job and first hoeing is done with long-handled hoes. The hoes used are six-inch hoes cut down to three inches. The labor thins the blocks left by the cultivators to one beet if possible, but no finger work is done. About 75 per cent of the blocks have single beets left in them after this hoeing operation. This operation costs about the same per acre as the normal first hoeing. There are very few weeds to be hoed due to the close cultivating job obtained.

The yields of beets have been very satisfactory, as shown in the following table:

Year	Acres	Tons per Acre	% Sugar
1939	388.1	19.43	17.76
1940	203.4	18.47	19.58
1941*	190	23.00	....

*Harvest not completed at this date. Estimated yield on acres harvested.

Grower number two used the same method during the 1941 season as described for Grower number one. However, he thinned the blocks left by the cultivator with short-handled hoes. The labor was instructed to leave only single plants. The stand averaged about 110 beets per 100 feet of row. The labor was paid the regular thinning rate of $7.50 per acre. Due to the blocking done by cultivation the labor was able to cover more ground per day and, therefore, made each laborer more effective in covering acres. Hoeing costs were reduced by the close job of cultivation and the fact that it was easy for the labor to clean up around the blocks when the thinning operation was done. This grower comments that this year due to his large acreage, some of the thinning was done "late." However, due to the cross-blocking job done when the beets were small, the plants did not suffer the usual setback incurred by late thinning. The plants were not spindly, nor did they turn yellow. The yield for this grower's crop for 1941,



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Beet cultivator with 12-inch adjustable weeder knives set for cross-blocking.
Photograph—courtesy Division of Agricultural Engineering, University of California, Davis.

when these operations were first done on a large scale, is as follows:

Year	Acres	Tons per Acre	% Sugar
1941	538.1	16.62	17.81

Grower number three for the past two seasons has approached this job of reducing the amount of labor necessary for thinning from a slightly different angle. He uses a single drop seeder and employs a very low rate of seeding. For the 1940 crop he planted approximately 4 lbs. of seed per acre, and for the 1941 season about 4.5 lbs. of seed per acre. In 1940 an ample stand was secured from the first planting. In 1941, like most other growers, some of his acreage had to be reseeded. The last plantings were made in late May and excellent stands were secured on all fields involved. After the beets were planted, the regular job of cultivating is done. When the plants reach a normal thinning size, long-handled hoes cut down to three inches are used to thin out the plants. Counts made in the field at thinning time have shown as many as 95 single plants per 100 feet of row. Some plants left were doubles

(Continued on page 12)

GROWERS' CROSS BLOCKING EXPERIENCES

(Continued from page 11)

but at harvest time the labor topped on an average approximately 115 marketable beets per 100 feet of row. The 1940 crop averaged approximately 18 tons per acre and the 1941 crop not yet completely harvested will be as good if not slightly better.

This grower says that he can use men to thin with long-handled hoes that cannot thin in the conventional manner. Older laborers find it difficult to spend the entire day on their knees. With long-handled hoes they can work at an efficient pace all day. The thinning and first hoeing costs in 1940 were approximately $4.35 per acre. 1941 figures were not available, but, as near as could be determined, were approximately the same as normal first hoeing costs.

As already stated, Growers four and five used cross-blocking and long-handled hoe thinning as emergency measures to save their crops when it was not possible to thin their beets in the usual manner. The beets involved in both cases were suffering from lack of space to grow when they were cross-blocked. It was hard for the labor to thin the blocks with their long-handled hoes, because of the large size of the plants. However, after thinning was finally completed, the beets recovered and grew satisfactorily.

At harvest time little difference could be noticed in the windrows as far as tonnage was concerned. Both growers felt that if the work had been done earlier, it would have been easier to do and a better job would have been obtained.

From the experience of these various growers, several facts stand out. If beets are to be cross-blocked, a good stand must be obtained. The cross-blocking operation should be done first, prior to the first regular cultivation. The job of thinning the blocks down to single plants can be done with either short or long-handled hoes. It should be started as soon as the plants are large enough to be thinned under normal conditions. The laborers involved can cover more ground per man, which, even if the cost per acre is the same, will mean that during this coming thinning season, our labor can be spread over more acres. The experiences of these growers indicate that normal yields of beets can be expected when the plants are handled in this manner. All of these growers who cross-blocked agree that cross-blocking reduces the number of weeds to be hoed around the beets, due to the close and complete job of cultivating done. This means reduced hoeing charges.

CROSS BLOCKING SUCCESSFUL IN REDUCING LABOR REQUIREMENTS

By P. T. REZNER, *Agricultural Department*
Spreckels Sugar Company

With a shortage of labor to be expected in 1942, it is timely and important to consider ways and means of meeting this shortage.

Cross-blocking the beets prior to thinning and hoeing has considerable merit when performed under the proper conditions. It should be carried out only when there is a good stand of beets. If the number of beets remaining in the blocks are not too thick, it is possible to eliminate hand thinning and use only long-handled hoes for weed control.

To plan on cross-blocking, a number of requisites are imperative:

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An increasing number of growers are obtaining satisfactory stands by cross-cultivating their beets. Great care must be exercised in setting implements used in cross-cultivating.

First: It is necessary to prepare an excellent seed bed to insure obtaining a perfect stand of beets.

Second: To effect a saving in the number of laborers and expense in thinning, the first cultivation "with the rows" must not leave over 1 to 1½ inches on each side of the row.

Third: Adjust the spacing of the discs and knives for cross-blocking according to the seedling stand. This is important to maintain the population of beets per acre.

Fourth: Cultivation and cross-blocking must be performed on time, with the beets at the proper age. Cultivation should start as soon as the beet row is visible to follow with the cultivators, since it will be a number of days before the field and equipment are ready to cross-cultivate.

A number of growers have been practicing cross-cultivation for a number of years, with their yields consistently equal to or greater than the district average. In one instance, the water grass was too thick for the labor in one portion of the field and they refused to thin it. The eight acres were then cross-blocked, the labor went back in, cleaned up the blocks at the current wage scale per acre and the field yielded approximately 18 tons per acre.

One grower cross-blocked 90 acres with an ideal stand and without doing any additional thinning carried the crop through to harvest with about 65 per cent doubles. The crop produced about 20 tons per acre.

Where there were large percentages of doubles, it was found necessary to delay harvest to the last to obtain a maximum growth on the large number of smaller beets occasioned by the doubles in the row.

Under certain conditions, the labor demands a higher rate per ton for topping and loading 20 tons per acre with a large number of small beets compared with a 20-ton yield with all singles.

Another development for cross-blocking, not yet attempted, will be to plant the field in 10-inch rows, and then cross-block to 20-inch centers. It will be possible to use short knives and cultivate the 10-inch rows before cross-blocking. To plant these 10-inch rows, use 20-inch spacing on the drills and double back, planting again between the 20-inch rows, leaving a row each 10 inches.

Spreckels SUGAR BEET Bulletin

PUBLISHED FOR CALIFORNIA SUGAR BEET GROWERS BY THE SPRECKELS SUGAR COMPANY

VOL. VI MARCH 1942 No. 3

WAR EMERGENCY
BONUS FOR EARLY 1942 HARVEST

When, last October, the Secretary of Agriculture announced that acreage restrictions for the 1942 sugar beet crop would be removed and it became apparent that the production of sugar was to become vital to our national defense, Spreckels Sugar Company provided in its 1942 sugar beet contract for a guaranteed minimum payment, as well as an increased price, to growers.

Now that contracting has been practically completed, it is vital to all concerned that nothing interferes with the production of sugar from the entire acreage contracted, and that growers commence the harvest of the crop as early as practicable so as to avoid interruptions that may be caused by rainy weather in the late Fall. Prolonged rains which interrupt harvesting may work severe hardships on both grower and processor.

As an inducement to beet growers to harvest early, even though the sugar percentages may not be as high as growers might have considered normal in previous seasons, the Spreckels Sugar Company will this year, because of the War Emergency, pay an additional bonus as follows:

Under the terms of the 1942 contract, as under the contracts for previous years, the beets are to be delivered in accordance with a schedule to be prepared by the Company.

After securing field samples of beets and determining their sugar content, Spreckels Sugar Company will announce a date on which it will commence to receive beets. For all beets delivered to it (in accordance with its schedule of deliveries) within 20 days from the date so announced, Spreckels Sugar Company will pay 75 cents per ton above the regular schedule of beet payments and allowances as defined in the 1942 contract.

We further assure growers that we intend not only to continue piling and storing of beets at our factories for this year, when the weather permits, but even to increase the quantity of beets to be stored. For the purpose of facilitating such increased storage, we have ordered two additional pilers, which are now being fabricated.

SINGLE SEED PLANTING OF SUGAR BEETS

By S. W. McBIRNEY, *Bureau of Agricultural Chemistry and Engineering, U. S. Department of Agriculture*

Experimental work with single-seed planting of sugar beets was begun in 1936 and has been continued since then. The studies have shown material savings in labor and other costs of obtaining satisfactory, thinned stands, particularly when such planting is used in conjunction with the recently developed segmented or singled seed. Pre-thinning stands obtained by this method, as compared with those obtained through conventional planting, are more uniform, less thick and contain more singles. As a result, the stands are better adapted to mechanized thinning, the primary purpose for which single-seed planting has been developed. Incidentally, the single-seed planted beets also can be thinned by hand at a faster rate than those planted in the usual way.

Experimental single-seed planters have given a high degree of uniformity in seed spacing. Commercial single-seed planting equipment has also been developed and is now available. The seedling distribution obtained with the commercial planters is very nearly as uniform as with the special experimental single-seed planters and the mechanism of these commercial machines is considerably simpler. In fact, many of the commercial planters already in use can be converted for single-seed planting by replacing the regular plates, seed cut-offs, seed knocker wheels, and hinged hopper bottoms with special single-seed equipment at around two dollars or less per hopper.

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Segmented seed, single seed planted sugar beets alongside a one-inch division stick. Background rows single seed planted with 50-cell seed plates and sack run seed at 15 pounds per acre.

Results obtained on a typical set of experimental plots put in with single-seed and conventional planting equipment at a seeding rate of about 10 to 12 pounds of seed per acre are summarized in Table I. As shown in the table, the percentage of beet-containing, one-inch lengths or sections of row which are single seedlings and therefore more readily hand or mechanically thinned, is higher with the single-seed planting than with regular planting. This is increasingly evident when smaller-sized screened seed, with fewer germs per ball, is used.

TABLE I
Planter Germination-Stand Count Summary (1941)

Planter and Plate Equipment	Seed	Per Cent of Beet-Containing Inch Lengths of Row Which Had Single Seedlings
Single-seed, with 54-cell seed plate	Small sized screened seed ($\frac{9}{64}''$ to $\frac{13}{64}''$)	53.1
Single-seed, with 50-cell seed plate	Sack run seed	46.0
Regular planter with 16-cell seed plate	Sack run seed	42.8

(Continued on page 14)

SINGLE SEED PLANTING (Continued from page 13)

Still greater differences would have been shown if a regular planting at 18 to 20 pounds of seed per acre, a more common seeding rate, had been included in the series of plots. Such plantings in other plots or in commercial fields average a third or less for the proportion of beet-containing inches having single seedlings. Then, too, the distribution of the beet seedlings with the 16-cell, regular plate and the 10- to 12-pound seeding rate is much less uniform as the seedlings tend to be in bunches.

The use of the recently developed segmented seed in connection with single-seed planting still further improves the results as to more uniform germination stands and larger percentages of singles. This segmented seed is obtained by running regular seed through a machine to break up the multiple-germ seed balls into single-germ portions or segments of balls and screening and grading the material to obtain a desired size and good germination. About half of the original weight of the seed is lost in the operation, but the resulting segmented seed contains approximately the same number of single germ segments as the number of multiple germ balls in the original seed, and the germination percent of the segmented seed is as good as that of the original seed.

Single-seed planting equipment has been made for use with this segmented seed, and experimental plantings were put in with it this past season. The accompanying illustration pictures one of these plantings alongside a counting stick graduated in inches. The adjacent rows were single-seed planted with sack-run seed at a seven-pound-per-acre seeding rate, using a 50-cell plate. Typical results of one of these plantings are summarized in Table II. A comparison is made in the table between a planting of segmented seed and one of small-sized (9/64″ to 13/64″), screened whole seed put in with the same equipment as used for the first planting shown in Table I, so that the results are comparable.

TABLE II
Segmented-Seed Germination-Stand Counts

Planter Equipment and Seed	Seeding Rate Lbs./Acre	Seedlings Per 100 Inches of Beet Row	Beet-Containing Inches Per 100 Inches of Beet Row	Per Cent of Beet-Containing Inches Which Had Single Seedlings
55-cell, single-seed plate and segmented seed ..	5	23.0	18.8	82.0
54-cell single-seed plate and small-sized ($\frac{9}{64}$″ to $\frac{13}{64}$″) screened, whole seed..................	9	48.5	30.7	52.5

As can be seen from Table II, the use of segmented seed increased the percentage of beet containing inches which were singles from slightly over 50 per cent to more than 80 per cent. With this large percentage of singles and a fairly good distribution of seedlings, the practicability of securing satisfactory thinned stands with a large percentage of singles is materially increased. These beets planted with segmented seed were thinned with a long handled hoe only, no finger work being used, and after-thinning stands of well over 100 beets per hundred feet were obtained with a high percentage of singles.

Both seeding rates shown in Table II were such that the cells dropped seeds about 1½ inches apart. The number of seedlings is somewhat less than might be expected because of various mortality factors. A somewhat higher number of beet-containing inches than that obtained with the segmented seed would be necessary so that the blocking could be safely done with a machine instead of a long handled hoe.

Experimental work is being continued with this segmented seed and with single-seed planting equipment to use with it. Test plantings will be made in a number of the beet-growing districts this year. Commercial planter manufacturers are following the developments closely and have been doing development work of their own on plate equipment for segmented seed. They will have planting equipment available for their planters by the time we are ready to go into this type of planting on a larger scale.

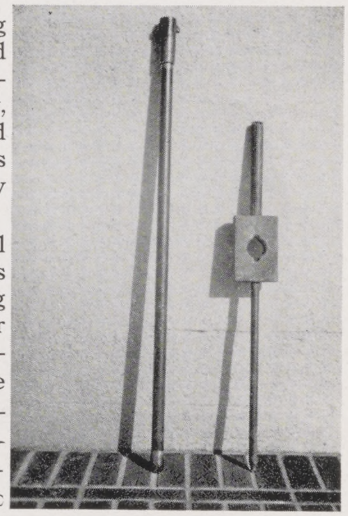
SCLEROTIUM PREDICTION AID TO BETTER YIELDS

By H. J. VENNING, *Agricultural Department Spreckels Sugar Company*

It is possible to determine prior to planting the amount of southern sclerotium root rot infection and probable crop loss that will result from this disease if the field is planted to sugar beets.

The method of making these predictions was worked out by Dr. L. D. Leach, Division of Plant Pathology, University of California, and the use of this system saves growers annually many thousands of dollars.

Prior to planting of all fields on which sclerotium is known or suspected of being present, the Spreckels Sugar Company obtains soil samples and determines for the grower the amount of sclerotia present. Fields containing a large number of sclerotia are not to be planted to sugar beets, thus avoiding heavy crop losses for the grower.



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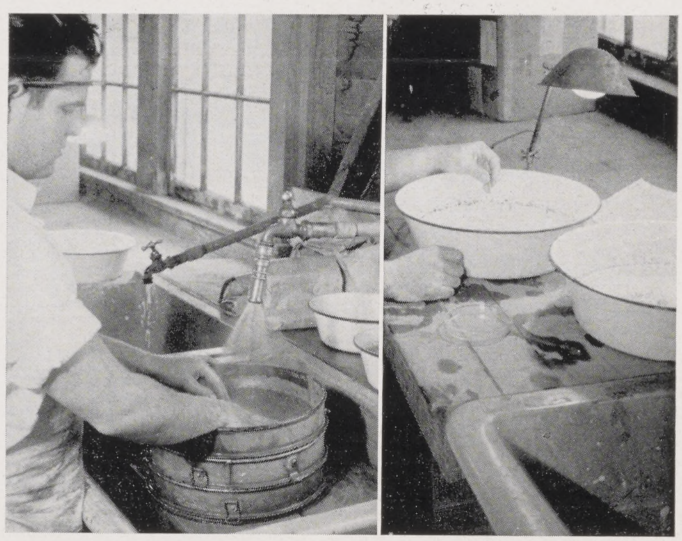
Tube and hammer used to secure soil samples for Sclerotium prediction.



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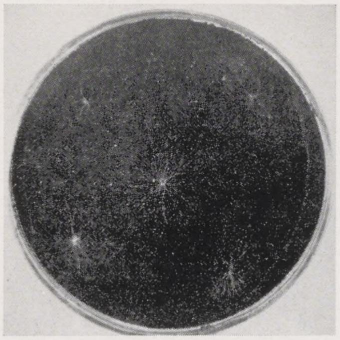
Weighed quantities of soil for Sclerotium determination are first washed through a series of screens, then the sclerotia are removed, counted, and germinated to determine the percentage that are viable.



The sclerotia are removed from the germination chamber and the number that have germinated (with white "thread-like" Mycelium growth) are counted, and prediction of crop damage is made on the basis of number of viable sclerotia in the soil.

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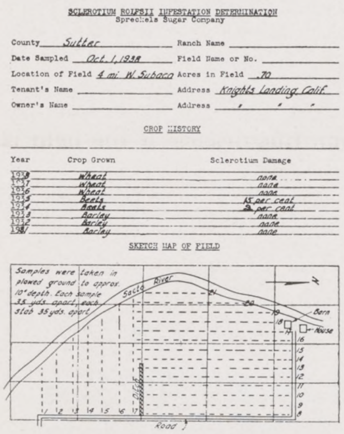


SCLEROTIUM ROLFSII INFESTATION DETERMINATION
Spreckels Sugar Company

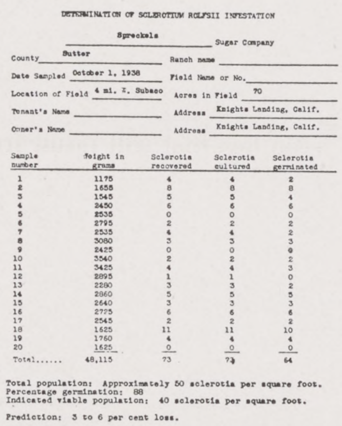
County Sutter — Ranch Name
Date Sampled Oct. 1, 1938 — Field Name or No.
Location of Field 4 mi. W. Subaco — Acres in Field 70
Tenant's Name — Address Knights Landing Calif.
Owner's Name — Address " " "

CROP HISTORY

Year	Crop Grown	Sclerotium Damage
1938	Wheat	none
1937	Wheat	none
1936	Wheat	none
1935	Beets	15 per cent
1934	Beets	2 per cent
1933	Barley	none
1932	Barley	none
1931	Barley	none

SKETCH MAP OF FIELD

Map and record of field from which soil samples were secured for Sclerotium determination.



DETERMINATION OF SCLEROTIUM ROLFSII INFESTATION

Spreckels Sugar Company
County Sutter — Ranch name
Date Sampled October 1, 1938 — Field Name or No.
Location of Field 4 mi. W. Subaco — Acres in Field 70
Tenant's Name — Address Knights Landing, Calif.
Owner's Name — Address Knights Landing, Calif.

Sample number	Weight in grams	Sclerotia recovered	Sclerotia cultured	Sclerotia germinated
1	1175	4	4	2
2	1655	8	8	8
3	1545	5	5	4
4	2450	6	6	6
5	2535	0	0	0
6	2795	2	2	2
7	2535	4	4	2
8	3080	3	3	3
9	2425	0	0	0
10	3540	2	2	2
11	3425	4	4	3
12	2895	1	1	0
13	2280	3	3	2
14	2860	5	5	5
15	2640	3	3	3
16	2725	6	6	6
17	2545	2	2	2
18	1625	11	11	10
19	1760	4	4	4
20	1625	0	0	0
Total......	48,115	73	73	64

Total population: Approximately 50 sclerotia per square foot.
Percentage germination: 88
Indicated viable population: 40 sclerotia per square foot.

Prediction: 3 to 6 per cent loss.

Sample of report by Dr. L. D. Leach showing number of sclerotia recovered from samples and crop loss prediction.

THE FERTILIZER SITUATION

By WARREN R. SCHOONOVER, *Extension Specialist in Soils, University of California*

California farmers will need to use the available fertilizer materials with the highest degree of efficiency if production of crops in general is to be maintained at normal levels and goals for increased production of certain crops are to be met. While no serious shortage of total fertilizer materials is anticipated for the coming year, there will be numerous adjustments in the supply of individual materials. Farmers will need to make adjustments in their management operations in order to meet changing conditions in the fertilizer supply situation.

The prospective supply situation with respect to the various plant food elements is about as follows:

The Nitrogen Situation. Supplies of ammonium sulfate, ammonium phosphate, urea, and natural organic concentrates such as blood meal, fish meal, etc., will no doubt be sharply curtailed, but requests for all of these materials can probably be met in part. Calcium nitrate and cal-nitro were imported from Europe and are not available. Calcium cyanamide is produced in Canada and export to the United States is much reduced at present. All of the ammonium phosphate for use in California now comes from Canadian sources and export is reduced. The natural organic concentrates are used for feed and some of them for industrial uses connected with defense, so they are expected to gradually disappear from the fertilizer picture.

Supplies of nitrate of soda for the Pacific Coast are being expanded greatly. It is hoped that sufficient nitrate of soda may be available to make up for deficiencies of materials listed above. Nitrate of soda is under strict rationing and limited to immediate use. Supplies of anhydrous ammonia are expected to be about normal.

Commercial nitrogen supplies should be augmented by the use of manure and the growing of leguminous green manure crops.

The Phosphate Situation. Supplies of treble superphosphate are reduced. The supply of various grades of ammonium phosphate has been sharply curtailed for the present. The Pacific Coast at present is dependent on the quantities released by the Canadian Government.

Ordinary superphosphate (18 per cent P_2O_5) is produced in California from materials available in the West. There should be enough of this material together with miscellaneous phosphate carriers to meet our requirements for phosphoric acid.

The Potash Situation. No shortage of potash is expected since both sulfate and muriate of potash are produced in California. There has been a temporary shortage on the West Coast due to a strike but, according to the November Potash News Letter of the American Potash Institute, shipments are increasing and the situation should improve.

Prices. Prices of fertilizer have advanced somewhat, but for most materials the advance has been less than the increase in value of farm crops in general. Prices of the so-called chemical materials have advanced from 10 to 30 per cent since the pre-war, 1936 level. The natural organic concentrates have advanced from 50 to 100 per cent since 1936. These are becoming less important in the fertilizer industry, as indicated above. Price increases on materials, like nitrate of soda, imported in ships will depend largely upon ocean freight rates and cost of marine insurance. Moderate increases in price may be expected, but there is now no reason to believe prices will soar as they did in the last war.

SOME EXPERIENCES WITH FERTILIZERS

By WM. R. LIDER, *Spreckels Sugar Company*

During 1941, when most planting of sugar beets was delayed and consequently fertilizers were applied late, it was observed that beets responded more rapidly to the earlier applied fertilizers than to the later applications. Several fields were observed where, instead of waiting until the beets were thinned, the fertilizer was side-dressed immediately after the first cultivation. The fertilizer was placed in the middle of the rows at a depth of four to eight inches, or deep enough to be in contact with moist soil for at least two weeks. The plants in these fields grew rapidly and excellent crops were secured.

Another case was observed where a grower had plowed under a heavy cover crop in April. On half of this field fertilizer was broadcast while preparing the seed bed, with marked results. This further emphasized the need of applying fertilizer so that plants can secure an abundance of nitrogen at, or shortly after, thinning.

In most applications nitrogenous fertilizers were applied at the rate of 75 pounds of nitrogen per acre or nitrogen and phosphoric acid carrying compounds were applied with a 16-20 analysis, using approximately 200 pounds per acre. Liquid ammonia was used to some extent and it appeared that users benefited in increased crops.

In my observations during the past season, I believe the most significant point is the early application of fertilizer. If possible, fertilizers should be applied in March or April or as soon as the plants can be fertilized after the first cultivation.

ARE MULTIPLE BEETS A PROBLEM?

By J. E. COKE, *General Agriculturist*
Spreckels Sugar Company

During the last few years there has been less emphasis placed on thinning beets to singles than in preceding years. This has been brought about because experience has proven that at least a reasonable percentage of doubles or multiple beets does not ordinarily reduce yields and because of less efficiency of field labor.

Increased labor costs and a possible scarcity of labor may result in 1942 in many more fields having a large percentage of multiple beets than ever before. This year there will undoubtedly be many fields thinned by cross-blocking, with little or no additional thinning. Under conditions of short labor supplies, this practice is to be encouraged, as all the data available to date indicate that little or no reduction in yields results from leaving doubles or multiple beets, providing the clumps which are left are not too thick.

However, there are problems which may develop from leaving multiple beets which should be taken into consideration. In order that these problems may be thoroughly reviewed, we are presenting the following discussions by L. D. Leach and Roy Bainer.

MULTIPLE BEETS MORE SUSCEPTIBLE TO ROT THAN SINGLES

By L. D. LEACH, *Associate Plant Pathologist*
University of California, Davis

Sugar beets left as doubles or multiples at thinning time are more apt to become infected by southern root rot than are single beets, according to data collected in several areas of the Sacramento Valley.

Under some conditions it has been found that satisfactory crops of sugar beets can be produced by leaving the seedlings in small blocks, and some investigators have shown that uniform spacing of single plants is not always necessary to obtain satisfactory yields.

In fields infested by the southern sclerotium root rot fungus (*Sclerotium rolfsii*) it appears, however, that thinning the seedlings to a uniform stand of singles is important.

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Severe infection of southern sclerotium rot on unthinned sugar beets. Over 90 per cent of the unthinned beets in the center row were killed by the fungus, while but 22 per cent of the plants in the normally thinned, adjacent rows were infected. The severity of infection on the unthinned row is due in part to the spread from primary infections to adjacent plants and in part to the greater susceptibility to infection of multiple beets.

It is well known that when one sugar beet becomes infected by the southern root rot fungus, the disease quickly spreads to other plants left in the same block. More important, however, is the fact that doubles or multiples are about three times as apt to become infected as single beets in the same field. This conclusion is based on observations of 56,000 beets in seven commercial fields in Yolo, Sutter, and Solano counties.

The averages for all determinations showed that whereas the fungus attacked 8.7 per cent of the single beets, 26.4 per cent of the doubles or multiples were infected. In the various fields the infection on multiples was from 2.4 to 4.2 times as great as on singles. On this basis, if a field is sufficiently infested to suffer a 10 per cent infection with a perfect thinning job, the same field would be expected to show a 20 per cent infection of plant units if half of the units were left as doubles or multiples; or as high as 30 per cent infection if the beets were merely blocked without thinning.

It is, therefore, suggested that in fields known to be infested with *Sclerotium rolfsii* care should be exercised in thinning to obtain a high percentage of single beets.

MULTIPLE BEETS AND MECHANICAL HARVESTING

By ROY BAINER, *Associate Agricultural Engineer*
California Agricultural Experiment Station

An ideal stand of sugar beets contains 100 to 120 (depending upon soil fertility and available moisture) uniformly spaced beets per hundred feet of row. Recently there has been a trend toward less uniformity in spacing and singling of beets in the thinning operation. This tendency is based upon the work of Larmer, Tavernetti and others, which indicates that the distribution of plants can be quite variable without affecting the yield of sugar per acre. For example, Larmer reports that a distribution of beets such as 2 plants on 20-inch centers will give approximately the same yield as one plant every 10 inches.

The tendency toward leaving beets in multiple stands will materially affect the performance of mechanical harvesters that top beets before they are lifted. In anticipation of using mechanical harvesters some thought and consideration will be necessary to obtain a higher percentage of single beets in the row in order to obtain the best machine performance.

For the past three years a concentrated effort has been made by the University of California, in cooperation with the U.S.D.A. and sugar companies, to develop machinery for mechanizing sugar beet production. The experimental variable cut topper developed on the project tops on par with average hand topping when working in fields that do not contain more than 15 per cent of the beets in multiple combinations. Under these conditions it is possible to keep the combined topping loss and top tare to 3 per cent or less, with the possibility of changing the initial adjustment to make the major part of this loss either tare or top. Since the machine does satisfactory topping where conditions are at all favorable, it appears that a better way of rating the quality of work would be on the basis of unacceptable beets. Unacceptable beets are those which are not cut through the crown in the topping operation.

Trials with the variable cut topper have shown that the unacceptable beets varied from 10 per cent by number (approximately 2.5 per cent by weight) in a field with 53 per cent of the beets in multiple combinations to 3 per cent by number (less than 1 per cent by weight) in a field with 8 to 10 per cent of the beets in multiple combinations. In a field in the inter-mountain states where the thinning was practically perfect (no doubles) observations showed no unacceptable beets. It is noted that the percentage of unacceptables by weight is much less than by number, indicating that the unacceptables are small beets, which usually result from doubles. Many of these beets would be left in the field by hand toppers. However, in a mechanical harvest system many of the small beets will reach the dump.

Beets that are irregular in size due to growing in multiple combinations also affect the operation of a mechanical digging unit. The fact that more than one beet must be handled when a clump is encountered is probably more serious than the variation in size. The digging unit built to work with the variable cut topper was designed to lift a beet regardless of diameter. Its operation is more satisfactory, however, when the beets are uniformly spaced.

The development of sheared beet seed may offer some assistance in obtaining a higher percentage of single plants. Extensive field trials will be conducted this spring to determine the advantages, if any, of sheared seed plantings for the purpose of securing singled stands with less labor.

LAMB FEEDING TRIALS SHOW VALUE OF BEET PULP

By W. M. HERMS, *Agricultural Extension Service, Woodland*
R. E. MILLER, *Professor of Animal Husbandry Division University of California, Davis*
R. D. JONES, *Agricultural Department Spreckels Sugar Company, Woodland*

EDITOR'S NOTE: This year's trial concluded two years of investigation in the feeding of pressed, siloed and dried molasses sugar beet pulp in a basal fattening ration for lambs as against the customary alfalfa hay and grain ration. A complete report of these trials has been summarized in mimeograph form and copies may be obtained by writing to any of the authors.

The lambs, feeding yards and equipment used in these experiments were furnished by Mr. Henry Gasser at his ranch near Woodland. Mr. Gasser supervised the feeding operations and the success of this project was due to the excellent work and cooperation of Mr. Gasser, Mr. Herms, Professor Miller and Mr. Jones. The Swanston Packing Company of Sacramento, purchaser of the lambs in the first trial, and the Mace and Greive Company of Dixon, purchaser of the lambs this year, assisted materially in providing dressing percentages, carcass grades, weights, etc.

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Cooperators in lamb feeding trials are (reading from left to right): W. M. Herms, R. E. Miller, Henry Gasser and R. D. Jones.

A field day and barbecue held on January 16, 1942, at the Henry Gasser Ranch and Yolo Town Hall, respectively, marked the conclusion of the 1941 trial and our two years' experimental feeding work with lambs. The large attendance and interest in the results of this and last year's trials has been most gratifying to all parties who have worked to show the place, economy and efficiency in a ration for fattening lambs of the various forms of sugar beet pulp when combined with alfalfa hay and barley so abundantly produced locally.

In the lamb feeding trials conducted in 1941 the type, number, size of lambs, and rations fed were practically the same as those used in the 1940 trial. The only exception was that an additional pen of black-faced lambs (122 head, the same as the other lots) were fed siloed pulp in competition with the lot of white-faced lambs receiving siloed pulp.

The results obtained in this year's trial were comparable to those of last year* with the exceptions that daily gain

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Lambs fed on siloed pulp and a basic ration of hay and grain made the greatest gain with an average gain of .271 pound per day.

was not quite so large nor the differences in gain between respective lots so pronounced. Also Lot III receiving dried molasses pulp made slightly better gain in this trial than the siloed pulp lot. In this trial the black-faced lambs did not prove superior to white-faced lambs in total gain or cost of gain.

The highlights of the results of the two lamb-feeding trials are:

1. **Rate of Gains:** The rate of gain of the lambs fed siloed pulp was significantly higher than that of the other three lots. The addition of siloed pulp to a basal ration of alfalfa hay, barley and molasses resulted in a definite increase in gain. Siloed pulp proved more palatable than pressed pulp and seemed to stimulate the lamb's appetite as shown by the greater consumption of hay.

2. **Cost of Gains:** The lambs fed wet pulp made considerably cheaper gains at current feed prices than those fed dried molasses pulp or alfalfa hay and barley. The cost per 100 lbs. of gain of $8.95 was particularly outstanding in the siloed pulp lot. The pressed pulp lot was $9.32, the dried molasses pulp lot $11.84 and the alfalfa hay and barley lot $12.42. The difference between siloed pulp lot and the hay and grain lot was $3.47.

3. **Replacement Value of Wet Beet Pulp:** Comparing Lot I (pressed pulp) with Lot IV (hay and grain), a ton of pressed pulp replaced 62.2 lbs. barley, 452.7 lbs. alfalfa hay and 23.9 lbs. of molasses.

Comparing Lot II (siloed pulp) with Lot IV (hay and grain), a ton of siloed pulp replaced 98 lbs. of barley, 492 lbs. alfalfa hay and 40 lbs. molasses.

4. **Slaughter and Grade Information:** The dressing percentage of the lambs in the dried molasses pulp lot was higher than that of the wet pulp lots. That of the hay and grain lot was the lowest.

In grade of carcass there was no great difference in the number of carcasses grading choice and good in the wet pulp and dried molasses pulp lots. There were about 40 per cent less choice and 20 per cent less good carcasses in the hay and grain lot than in any of the other three lots.

5. **Sugar Beets and Livestock:** Valuable information was developed which demonstrated that it is possible and feasible to market home-grown feeds through livestock and by so doing to produce large quantities of manure so vital to the maintenance of soil fertility. The use of spaghnum peat moss as bedding in this year's trial was found to be very satisfactory in keeping the lots clean and dry and produced manure of excellent quality.

(Continued on page 18)

*Refer to the March 1941 issue of the Spreckels Sugar Beet Bulletin.

LAMB FEEDING

(Continued from page 17)

A COMPOSITE AVERAGE OF THE 1940-1941 LAMB FEEDING TRIALS

Comparison of rations using pressed beet pulp, siloed beet pulp, molasses dried beet pulp and no beet pulp.

(Pounds unless otherwise specified)

Ration	Pressed Pulp	Siloed Pulp	Molasses Dried Pulp	Hay and Grain
Average feeding period (days)	95	95	98	98
Total number of lambs	262	261	263	257
Average final weight per lamb (1)	92.7	95.6	94.1	87.3
Average initial weight per lamb (2)	67.0	67.1	66.3	65.0
Average gain per lamb	25.7	28.5	27.8	22.3
Daily gain per lamb	.274	.303	.286	.230
Feed consumed per lamb per day:				
Ground barley	.82	.82	.83	.85
Beet pulp	6.15	6.16	1.06	
Chopped alfalfa hay	1.19	1.35	1.15	2.17
Cane molasses	.38	.38		.38
Average daily dry feed per lamb	3.06	3.07	2.94	3.30
Feed consumed per 100 pounds gain:				
Ground barley	300.2	270.7	291.6	370.1
Beet pulp	2248.7	2029.4	371.0	
Chopped alfalfa hay	436.4	446.2	400.6	945.4
Cane molasses	139.4	125.7		166.3
Cost per 100 pounds gain	$9.32	$8.95	$11.84	$12.42
Slaughter data:				
Number of lambs	262	261	262	255
Final weight per lamb	92.7	95.6	94.1	87.3
Dressed weight per lamb	46.5	48.3	49.4	44.2
Dressed yield per cent (3)	50.1	50.6	52.3	49.5
Grade of carcass:				
Per cent choice	29.0	32.9	33.6	19.2
Per cent good	33.6	36.0	33.6	26.7
Per cent medium	35.1	25.3	31.3	36.5
Per cent common	2.3	5.8	1.5	17.6
Grade index (4)	3.9	4.0	4.0	3.5

(1) Full weight out of feed lot less 4 per cent shrink (sale weight).
(2) Full weight into feed lot less 3 per cent shrink.
(3) Dressed yield is based on sale weight of lambs and chilled weight of carcasses.
(4) This was determined by allowing an arbitrary value of 5 for choice, 4 for good, 3 for medium and 2 for common, and then finding the average.

GROWER GETS RESULTS WITH FERTILIZERS

By GLENN McDOUGALL, *Agricultural Department Spreckels Sugar Company*

A grower in the Blanco area in the Salinas Valley profited by the proper kind of fertilizer applied at the right time. Immediately after this grower's beets were planted, February 4, 1941, it started to rain and 10 inches fell before the beets could be thinned. Right after thinning, 6 more inches of rain fell, making a total of 16 inches of rain since the time of planting. When the rains finally ceased, the beets had been in the ground almost three months. The soil, being heavy, was in a saturated condition. The beets made little growth and were of a yellowish green color. As soon as tools could get on the ground, it was cultivated and cleaned of weeds, and soon after, the beets turned green. These beets grew for about three weeks, then began to turn yellow again.

The nitrate indicator was used on the beet leaves, and showed a deficiency of nitrogen. The amount of soil moisture was determined, which showed that the moisture in the first 12 inches of soil was at the wilting point, with high moisture from 12 to 36 inches—free water at 4 feet.

Only one irrigation was planned and an early harvest was anticipated, so it was not advisable to apply nitrogen in the ammonium form. As nitrates are available to the plants immediately, it was decided to put on 300 pounds of nitrate of soda. This was done and the field was irrigated rapidly by forcing the water through the beds.

A week after this application of nitrogen, the beets began to show a green tinge to the leaves. At harvest, this field yielded 20 tons of beets per acre with 18 per cent sugar.

This grower took care of his problem as the year went along. The situation was studied carefully. All angles were looked into before any decisions were made.

Each grower has his individual case to work out. Too much care cannot be used in studying the problem of each field in order to select the proper fertilizer, apply it in the proper way at the right time and in adequate quantities and to hasten the subsequent cultural practices so that the crop can utilize the fertilizer applied.

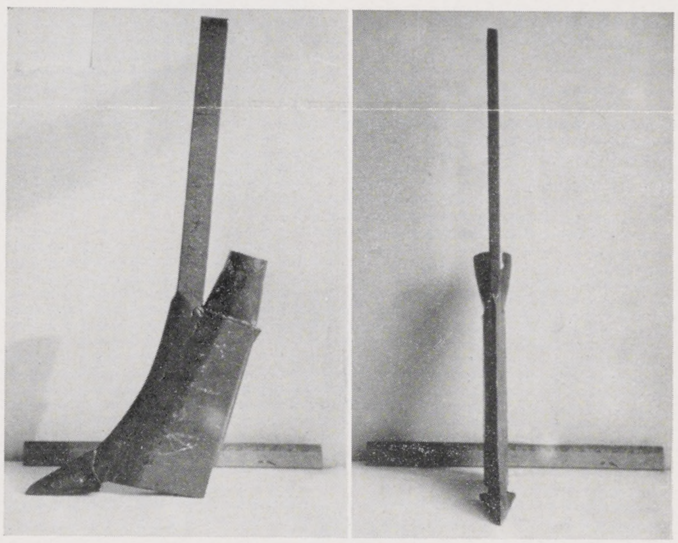
DEEP PLACEMENT OF FERTILIZER NOW POSSIBLE

By W. B. MARCUM, *Agricultural Department Spreckels Sugar Company*

Sugar beet growers who side-dress fertilizer into the soil want an opener to place the fertilizer as deep as possible. Other requirements of a good fertilizer opener include ease of entering the ground, non-furrowing, light draft, and non-clogging. Next to type and quantity of fertilizer used, placement of fertilizer is the most important single factor.

Extensive tests of sixteen fertilizer openers were made by the Division of Agricultural Engineering, Branch of the College of Agriculture, University of California, Davis, in the spring of 1940. These tests were reported in the October, 1940, issue of the Sugar Beet Bulletin, Vol. IV, No. 10, and it was mentioned that two openers appeared to meet the above requirements better than most of the others tested. These two openers were the diamond point type and the spear point type.

As a result of these tests, a spear point opener has been further developed which will place fertilizer to an 8-inch depth (see photographs). This opener has been strength-



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Fertilizer opener developed by the Division of Agricultural Engineering, University of California, for the deep placement of commercial fertilizers.

ened considerably with a standard of high carbon steel, heat treated, and of 5/8 in. x 1 1/2 in. x 19 3/4 in. stock. The

opener is heavier, more streamlined, reducing tendency to choke up, and takes less stock. The special curved shape of the standard permits its operation through moist and trashy soil conditions, tending to clean itself of mud or weeds. A small opening is provided at the rear of the boot, close to the top, so that the operator can readily see if the fertilizer is flowing properly.

Furrowing or lateral movement of the soil has not been entirely eliminated with this opener. Small beets planted in rows spaced 20 inches apart may be covered up to some extent. This criticism is not as applicable when side-dressing the wide row of a 16-24 in. or 18-22 in. row spacing. However, the opener is a considerable improvement over other types and a number of growers are expressing satisfaction with its performance.

The spear point opener is now in commercial production and can be purchased locally by growers when desired.

MORE TONS PER ACRE BY SUPERVISED THINNING

In the present emergency, efficiency in the use of labor is imperative.

Careful and constant supervision of beet thinners should aid in leaving the desired stand. This is of primary importance in obtaining maximum production.

Selections of vigorous beets, compensating for "skips," and the elimination of weeds are all factors related to yields. The degree to which a good job of thinning is obtained is often in direct proportion to the supervision given by the grower.

TONNAGE OF BEETS AS DETERMINED BY POPULATION

Spacing of Beets in Rows 20 in. Apart	No. of Beets Per Acre	Tons Beets Produced Per Acre Estimated Weight Per Beet—1 Lb.
12" apart	26,136	13.07
10" apart	31,363	15.68
8" apart	39,204	19.60

FERTILIZER PRACTICES IN THE SALINAS AREA

By R. S. LAMBDIN, *Agricultural Department Spreckels Sugar Company*

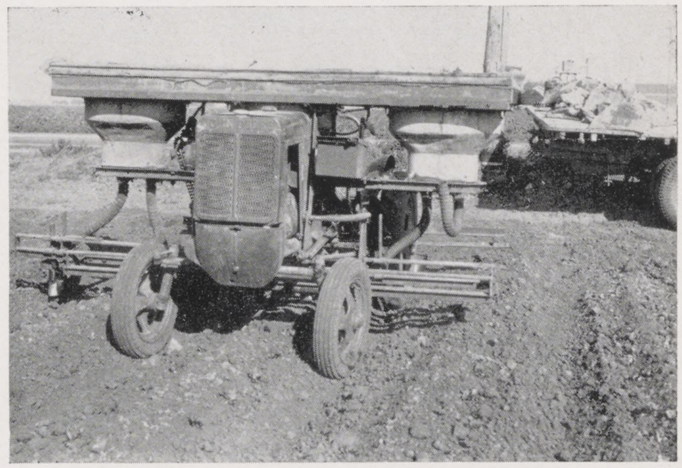
The use of commercial fertilizer has become a general farm practice employed in the production of practically all sugar beets grown in Monterey, San Benito, Santa Cruz, and southern Santa Clara counties.

Due in part to the soil-building requirements set up by the Sugar Act of 1937, sugar beet growers began a very extensive fertilizer program. Since 1937, many different kinds of fertilizer have been used in various amounts and at varied dates of application. The results in many cases were profitable; in some cases, unprofitable.

Almost all commercial fertilizers are applied in one application as soon as possible after the beets are thinned. The fertilizer becomes available during the rapid growing period when an abundance of plant food is necessary. There are a few growers who broadcast fertilizers prior to listing. This is usually followed by an additional application later in the season. The principal reason for following this practice is that it results in more rapid growth early in the season and aids in the decomposition of coarse organic matter in the soil. In some cases, growers drill their fertilizer into the bed when planting. This type of application also aids rapid growth in the early stages and is advantageous where only one or two irrigations are applied to the crop.

Many kinds of fertilizers are being used throughout the district and although each farm presents a fertilizer problem of its own, in general the use of nitrogenous fertilizers is on the increase. Fertilizer experiments and general field observations have shown the value of nitrogen in crop production, while the use of potash and phosphate has given little or no increase.

The quantity of fertilizer used varies greatly, although generally about 80 pounds of nitrogen per acre (400 pounds Ammonium Sulphate or 500 pounds Nitrate of Soda) is considered standard.



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Fertilizer machines, similar to the one pictured, are mounted on cultivator frames or on wheel tractors (as shown) and used to apply most of the fertilizer in this district.

The necessity of following a carefully controlled fertilizer program in the coming season is more apparent than ever before. Increasing the yield of sugar per acre will help considerably in holding to a minimum the rising production costs. Increased yields also will help lessen the country's need for sugar.

MAXIMUM PRODUCTION REQUIRES MAXIMUM BEET POPULATION

By G. P. WRIGHT, *District Manager, Sacramento District, Spreckels Sugar Company*

One method of securing maximum sugar content is to insist upon per acre population of beets as great as the natural and artificial fertility of the land will permit. Very large and badly shaped beets definitely have a lower sugar content than smaller beets. On fertile lands the extremely large beets are caused by poor stands.

Population per acre should be extended to the full producing capacity of the land. In some areas, this may require a spacing of 12 in. by 12 in., or 26,136 beets per acre, while in other fields a spacing of 8 in. by 20 in., or 39,204 beets per acre, may be required. It is of great importance to have the stand of beets distributed so that each plant will have approximately an equal land area from which to obtain nutriment.

The per acre pre-harvest cost of land, equipment, seed bed preparation, seeding, thinning, hoeing, and irrigation is exactly the same for a population of 25,000 as for 33,000 beets per acre. Obviously, therefore, one of the easiest methods of increasing income is to increase stands to the extent of soil fertility.

(Continued on page 20)

MAXIMUM PRODUCTION *(Continued from page 19)*

The securing of maximum population is far more important than to insist upon absolute single plant thinning. Under normal conditions of fertility, 10 or 15 per cent doubles left by the thinners has no depressing effect upon the yield.

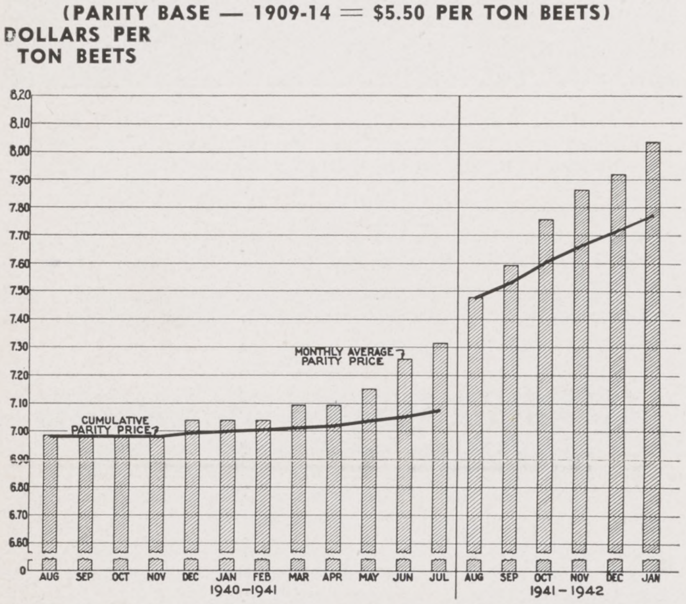
There has been sufficient experimental and also actual field work done to know that an even distribution of beet population over each acre of land is far more important than thinning to a single plant.

The importance of plant population in relation to per acre income would naturally lead to proper supervision of thinning labor. Far too little attention is paid to the teaching and supervision of thinning crews. The majority of farmers turn their thinning over to a contractor or foreman and spend no time in their beet fields.

Growers should determine the plant population they desire previous to thinning. Then they should spend some time supervising the thinners each day, teaching the thinners the proper method of doing the job and making frequent field measurements to be certain of the plant population after thinning.

JANUARY PARITY PRICE OF SUGAR BEETS — $8.03

(PARITY BASE — 1909-14 = $5.50 PER TON BEETS)



EARLY APPLICATION OF NITROGEN NECESSARY

By H. T. CARLSON *and* W. C. WATERMAN, *Agricultural Department, Spreckels Sugar Company*

In 1941, approximately 7,000 acres out of a total of 35,000 acres of sugar beets being grown for the Spreckels Sugar Company in the Sacramento and San Joaquin valleys received commercial fertilizers. The types of fertilizer used included Ammo-phos, anhydrous ammonia, nitrate of soda, sulphate of ammonia, super-phosphate, uramon, and various mixtures. The manner of application varies widely throughout the district. Some of the methods of applying fertilizer are:

1. Drilled in below the seed at planting time. This is fundamentally a good idea, although there is a hazard of loosening the soil so that it will dry out, thus preventing germination.

2. Broadcast onto a cover crop and plowed under immediately. This practice has considerable merit and will undoubtedly become more popular.

3. Drill near the beet row (side-dress) after the beet plants have made some growth. Until recently, equipment was not available to place the fertilizer over 3 to 4 inches deep. The results were frequently disappointing. Recent developments in machinery and tools make it possible to place the fertilizer 6 to 8 inches deep and it is anticipated the results will be improved.

4. Application of anhydrous ammonia or dry inorganic fertilizers in irrigation water. The emphasis is being placed on applying most or all of the nitrogen in this form with the first irrigation. This practice has the disadvantage of late availability of nitrogen because it cannot be applied until the crop is irrigated.

5. Application through rain machines. Both anhydrous and dry forms of inorganic nitrogen fertilizer have been applied through rain machines. Results indicate that if a dry form of fertilizer is desirable, better results can be obtained by side-dressing as deeply as possible at a date as early as possible.

6. Drilling fertilizer before planting. In the San Joaquin Valley, with its normally low rainfall, fertilizer has been applied in the fall by drilling to the same depth as the land is plowed prior to seed bed preparation. This practice has considerable merit for consideration where leaching from winter rains is not a factor.

7. Application of fertilizer prior to forming of beds for ridge planting. This is usually accomplished by first listing the field, placing the fertilizer in the bottom of the open furrow, then relisting, splitting the original bed and forming it over the top of the fertilizer. To obtain the proper depth, it is usually desirable to place the fertilizer 2 to 3 inches below the bottom of the furrow.

The possibilities of commercial fertilizers becoming increasingly important in the production of sugar beets appears good. There are a few growers at present who have obtained consistently good results from their fertilizer applications. The numerous attempts over a long period of years with only negative results have developed a few precepts that are indicative for the future:

1. Fertilization will be most successful if practiced on fields capable of producing a good crop without fertilization.

2. Commercial fertilization is not a panacea for marginal lands.

3. Inorganic plant food must be used in combination with organic matter in the soil.

4. Successful use of commercial fertilizers depends upon using the proper mixture and the proper amounts applied correctly for depth and time of application for each piece of land. The variations in rainfall and climate from year to year make it difficult to anticipate plant food requirements in a given piece of soil. We are, however, concerned for the most part in providing high nitrogen supply, although, if the nitrogen is applied too late or in too large quantities, it can depress the sugar content sufficiently to offset the increase in tonnage.

The present wartime emergency has affected the commercial fertilizer supply and it is questionable if there will be either a selection of material or a satisfactory supply.

Spreckels SUGAR BEET Bulletin

PUBLISHED FOR CALIFORNIA SUGAR BEET GROWERS BY THE SPRECKELS SUGAR COMPANY

VOL. VI APRIL 1942 No. 4

STRUCTURES FOR FARM DITCHES

By J. E. CHRISTIANSEN *and* N. E. EDLEFSEN
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(Davis, California)

When we speak about farm ditch structures we have in mind all types of irrigation headgates, check gates, drops, culverts, bridges, etc., that are used in connection with open ditch irrigation systems on the farm. The need for structures in farm ditches will depend upon (a) size of ditch or flow to be carried, (b) type of ditch, whether permanent, or constructed annually, and (c) the type of soil, whether or not it erodes easily. On many farms, where rather small irrigating streams are used, relatively few ditch structures are required. These will probably consist of gates at main diversion points, and probably a few culverts or small bridges. The water is controlled at other points by using portable metal or canvas dams, or by shoveling up earth dams and is admitted onto the field by cutting temporary openings through the ditch bank. As the size of the stream increases, it becomes more difficult to control water in this manner, and structures become necessary. This is especially true in sandy loam soils that are easily eroded. The result of shoveling earth from the banks of the ditch repeatedly to build temporary earth dams, which are largely washed away as soon as they are cut, is very quickly evidenced by widened ditches, and scarcity of available earth. Ditch banks are weakened, holes are dug away from the ditches, and soon a very undesirable condition exists. Too often the irrigator attempts to work without getting into the water. When structures are not used, satisfactory ditch conditions can

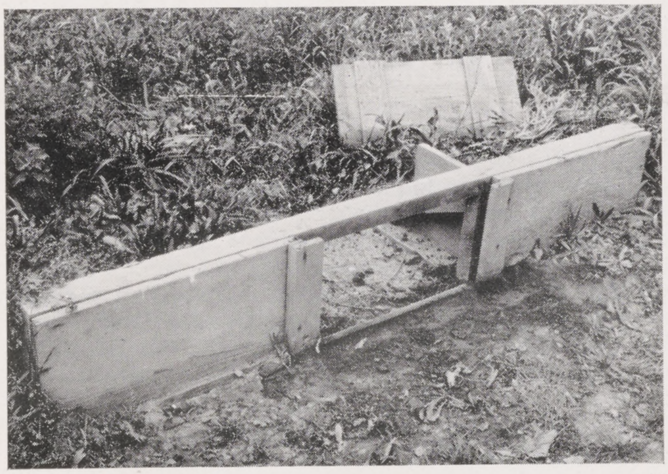

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Fig. 1.—Single wall field gate with apron below opening.

be maintained only where all excess earth for building dams, etc., is taken *from the bottom of the ditch upstream from the dam.* When the dams are removed special care should be exercised in salvaging as much of the material as possible and carefully piling it on the ditch bank for future use. Holes dug in the bottom of the ditch upstream

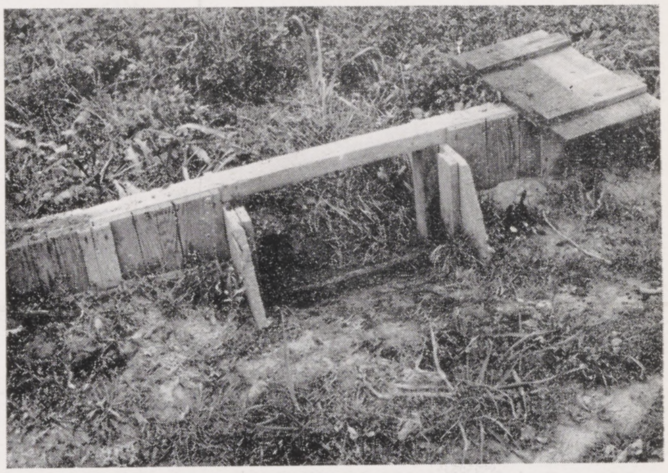

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Fig. 2.—Single wall field gate with boards at the sides of the opening.

from a diversion point will be partially filled in by deposition of silt.

Irrigation structures may be classified according to the purpose for which they are used. Unfortunately there is no standard terminology used with reference to irrigation structures, and the same structure is called by many different names in different localities. Such terms as "head gates," and "irrigation boxes," are widely used and may refer to any type of structure. The terms used here are those deemed most descriptive of the structure from the standpoint of the purpose for which it is used, although there may appear to be little resemblance between structures of the same type made from different materials.

The term "field gate" is used to refer to structures used in the side of a ditch to admit water from the ditch on to the field. They are commonly used for border strip or basin irrigation of alfalfa, and other crops that are irrigated by flooding. Such structures should be fairly watertight when closed. They must be inexpensive, because large numbers are required. They are made from wood, from concrete pipe with concrete headwalls and sheet metal slides, from poured concrete with wooden gates, and from galvanized sheet metal.

The terms "stop gate," or "diversion gate" are used for structures placed in the ditch for the purpose of completely shutting off the flow. Such structures are used at intervals in head ditches, and at points where ditches divide into two or more branches. These structures are not needed in such large numbers, and they must be constructed so that they will withstand the erosive action of the water flowing through them for long periods. Ordinarily they must have relatively large waterways, so as not to form obstructions and decrease the capacity of the ditch.

The term "check gate" is used for structures placed in the ditch to control the water level for the purpose of diverting part of the flow to the field, or into another ditch. A "drop" is used to reduce the effective grade of the ditch

(Continued on page 27)

DISEASES OF THE SUGAR BEET

By D. G. MILBRATH, *Plant Pathologist*
California State Department of Agriculture

The sugar beet, like most agricultural crops, is confronted by several natural enemies. By natural enemies is meant those living organisms which attack and live on the sugar beet while it is growing in the field. Among such organisms may be mentioned those which cause plant diseases.

For convenience of discussion, the most outstanding diseases affecting the sugar beet may be placed in four groups:

Group I. **Diseases caused by soil-borne organisms.**
1. Sugar beet nematode.
2. Root-knot nematode.
3. Root-rotting fungi.

Group II. **Diseases caused by fungi carried to the sugar beet by air-currents and splashing rain.**
1. Rust.
2. Leaf spot.
3. Downy mildew.
4. Powdery mildew.

Group III. **Diseases (virus) transmitted by insects.**
1. Curly top.
2. Mosaic.

Group IV. **Seed-borne diseases.**
1. Leaf spot.
2. Downy mildew.

An extensive discussion of each of the above-named diseases would require considerable space. Discussing the diseases in groups is practical from a control standpoint, and, after all, the grower is deeply interested in what may be done to avoid or control the pests.

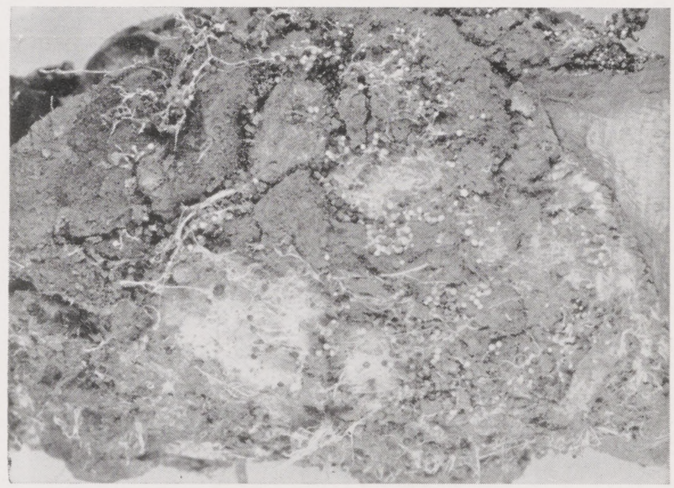
Among the soil-borne organisms the two species of nematodes, sugar beet and root-knot nematodes, are difficult to eradicate once they have become established in soil. Both thrive on the sugar beet. The root-knot nematode retards growth, and the sugar beet nematode not only retards growth but also reduces the sugar content.

A large number of different chemicals have been tried in efforts to eradicate these nematodes, but results have been discouraging. The most practical method of reducing the number of root-knot nematodes consists of plowing the land several times during the summer months, causing the nematode to be dessicated or baked out. The sugar beet nematode is not dessicated as easily. It transforms the wall of the female's body into a hard shell which resists unfavorable conditions. It can be seen readily that the two nematodes are not controlled easily when they infest a piece of land.

Another practical control measure consists of a five-year rotation. But crop rotation, in this case, is limited to a few crops, including wheat, barley, and sorghums. Prevention of introduction and prevention of spread are essential. Both nematodes can be introduced with soil on farm machinery which was used previously on infested land; therefore, such machinery should be thoroughly hosed off with water before it is moved onto the land. Irrigation and flood waters running over infested land will carry the nematode. When a small area in a field is known to be infested, that area should be seeded, cultivated, and irrigated separately.

Root-rotting fungi were placed in the same group with nematodes. Among these fungi may be named *Rhizoctonia solani, Phoma betae, Pythium aphanidermatum,* and *Phytophthora drechsleri.* All of these are semiaquatic or cool soil fungi, and they thrive in wet and cool soils. They have been found most frequently in the low and wet areas of the field. From these facts conclusions can be drawn that a well-drained and leveled piece of land will develop the least amount of root rot. Irrigating by the flooding method is conducive to aiding the root-rotting fungi. On page 70 of the Sugar Beet Bulletin, May 1941, a photograph was reproduced of a field worked into beds and furrows, the latter for irrigation. The legend under the reproduction by F. J. Veihmeyer is a very good recommendation for control of root-rotting fungi by regulating the irrigation water.

What was stated about nematodes holds true for Sclerotium rolfsii, the fungus causing southern root rot. It may be added that this fungus can be introduced into land with soil and refuse returned from sugar beet dumps. While this fungus does not attack as many different plants as the root-knot nematode, nevertheless, once established, it has little difficulty in maintaining itself in soil. Small, rounded bodies with protective coatings, known as sclerotia, carry over the fungus in soil and are also a means of spreading it. Again comparing Sclerotium rolfsii with the two nematodes, it may be stated that not one of the three can travel to a piece of land through its own locomotion, nor is any one commonly spread by air currents. Spread is facilitated by man or farm machinery moved by man or infected plants set out by man.



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Small, round sclerotia and mycelium of Sclerotium rolfsii, causing southern root rot of sugar beets.

In Group II, diseases caused by fungi carried by air currents, rust, leaf spot, downy mildew and powdery mildew are outstanding. Occurrence on sugar beets is facilitated by prolonged, high atmospheric humidity and continuous rains. Wet soils, particularly with standing water, whether on account of rain or heavy irrigation, are conducive to the development of these diseases. Well-leveled land, adequate drainage, and controlled irrigation in furrows are the most practical means of controlling these diseases.

Virus diseases were mentioned in Group III. A virus is an infectious material which has received a vast amount of attention in recent years by plant pathologists. Some investigators advance evidence of a virus being a self-increasing chemical, while others adhere to the conclusion that a virus is a living organism, although so small that it cannot be seen under the microscope. Whatever it is, there is undeniable evidence that viruses cause injurious diseases of plants.

As a general rule, viruses do not survive in soil. They survive in plants and are carried from one plant to another by insects. In the case of curly top of sugar beets, a leaf-hopper, Eutettix tenellus, is the common transmitter of the causal virus. Since quite a large number of plants other than sugar beets are susceptible to this virus, the leaf-hopper readily picks up the infectious material.

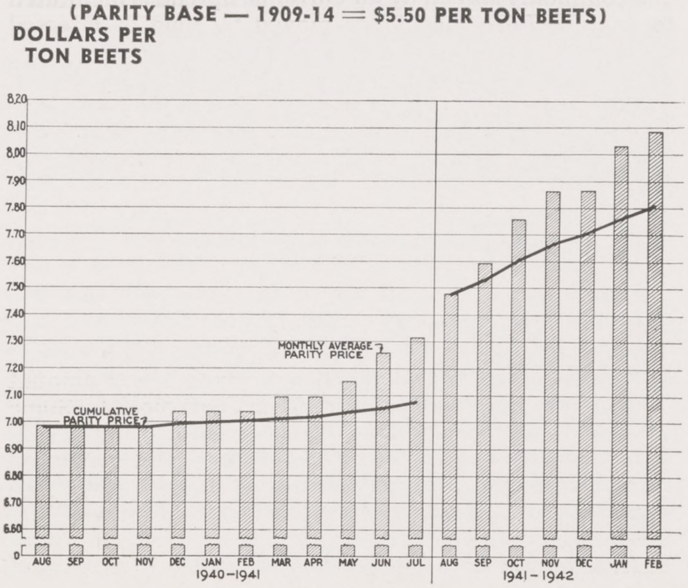
Control of the disease has received a great amount of attention and has presently resolved itself into three approaches: early planting, resistant varieties of sugar beets, and combating the leaf-hopper in its winter haven. During the past years, spraying plants (weeds) in certain foothills has yielded results which greatly outvalue the cost.

Among the seed-borne diseases in Group IV were mentioned leaf spot and downy mildew. All of these are caused by fungi. The fungi adhere to the seed coat, and when the seed lies in wet soil after planting, they increase in quantity and attack the young sprout as it emerges from the seed.

It was stated previously that the fungi causing leaf spot and downy mildew on sugar beets may be carried to the plant by air currents. But these fungi have a means of carrying over from year to year. The commonest means of carry-over is on seed and on chaff mingled with the seed. In a discussion of control of these diseases by means of seed treatment, it would be amiss to neglect damping-off of sugar beet seedlings. While leaf spot and downy mildew can develop from fungi on the outer surface of the seed, damping-off is caused by fungi in the soil, principally Rhizoctonia, Pythium, and Phytophthora species. To control seed-borne damping-off fungi, seed treatment is recommended. Logically, it may be asked, why treat seed when the fungi are in the soil? The answer is found in the material and method of treatment. Metallic compounds containing either mercury or copper are employed. The compounds are applied in the dust form. The dust adheres to the outer surface of the seed and after planting is a guard against infection of the young sprout by fungi in the soil surrounding the seed. It is thus that a heavier stand after seed treatment may be explained.

FEBRUARY PARITY PRICE OF SUGAR BEETS — $8.09

(PARITY BASE — 1909-14 = $5.50 PER TON BEETS)



CROSS-BLOCKING SUGGESTIONS

By W. B. MARCUM, *Agricultural Department Spreckels Sugar Company*

Sugar beet growers are expressing considerable interest in the use of cross-blocking methods during the 1942 season. Present expectations are that a fairly large acreage will be thinned by this means.

Although cross-blocking, or cross-cultivating, has not been practiced to any great extent in California, studies have shown that this practice has certain advantages well worth consideration. It is now apparent that with improvement of methods, California growers may realize a saving in thinning labor at a reduced cost.

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Cross blocking on W. H. Duffy's ranch, Sutter Basin, with a two cultivator unit equipped with flat weeder knives.
Courtesy of Mr. S. W. McBirney, U. S. D. A.

Recognizing that each field of beets must be considered individually in any recommendations, the Spreckels Sugar Company has drawn up a set of general suggestions which may be used as a yardstick in any intended cross-blocking operations:

1. Plan to set up cultivators early as cross-blocking is more easily done with very small beets.
2. Select a square-turn cultivator knife which will fit the cultivator standards. Cut blade of knife so that the desired spacings of blocks can be obtained.
3. Making a small cut and leaving a small block is the most desirable practice because it is adapted to both good and poor stands. It is generally recommended that 2-inch blocks be left with a spacing of five inches from center to center.
4. Two-inch blocks on 5-inch centers are better adapted to long handled hoeing and make possible better selection, for a more even spacing.
5. To set up cultivator, arrange one knife in the middle of the cultivator and place right hand knives on one side and left hand knives on the other. Knives should be staggered to prevent clogging.
6. Do not use discs with the knives unless absolutely necessary. The added weight of discs hampers cross-blocking operations considerably.
7. Try one strip through the field to determine the necessary adjustment for suction. Best results can be obtained if knife is nearly flat.

All Field Superintendents in the Sacramento district have a set of cross-blocking knives for demonstration. In addition, cultivators equipped with recommended knives are on display at the Woodland Factory and in the Company yards at Sacramento. A number of local implement dealers in Sacramento and Woodland are planning to set-up demonstrations of cross-blocking equipment.

EACH FIELD AN IRRIGATION PROBLEM

By GUY D. MANUEL, *Agricultural Department*
Spreckels Sugar Company

Irrigation practices in our beet growing areas include all the usual types of irrigation. To set up a standard or desirable practice of irrigating beets would be impossible with the varied soils and other conditions encountered. Overhead sprinklers, flooding, use of furrows or beds, and sub-irrigation are all common to the California beet grower. Each method has its own particular advantages and disadvantages. In selecting any one method, the grower must know the condition he will need to meet.

The topography of the land has a great deal of influence on irrigating. Leveling land has shown itself to be an important aid to proper irrigation, as the distribution of moisture is more even, and the flooding of low spots is eliminated. Also, land that has been leveled properly makes the application of water easier, and in many cases more economical, as fewer head ditches may be needed.

The number of applications of water put on in a growing season varies as much as the method. Anywhere from one to six irrigations may be applied, depending on the soil and climatic conditions. Some growers, in special cases of high water tables, find they can get along without irrigating. To say it is the custom or practice of a district to apply three applications of water may be true for the majority of the growers in that area, but to use that as a guide is erroneous because of soil variations and even seasonal changes.

Although the method and number of applications may vary widely, the fundamental practices or principles of irrigation are the same, regardless of the soil or other factors. Too much or too little moisture is detrimental to the plant development. It is to the interest of the grower to have moisture available to the plant in the soil at all times. Periodic checks should be made of the moisture content during the entire growing season to see that there is sufficient moisture, but not an oversupply, available for growth. Use of the soil tube, probe, or shovel will aid the grower in determining the moisture condition of this soil, both near the surface and in the sub-surface, as each are equally important.

Over-irrigation and under-irrigation are both harmful to the beet, yet they are common occurrences, either due to lack of supervision or a lack of knowledge of the sub-moisture conditions before and after irrigating. Allowing the water to run to the end of a furrow and then shutting it off may give good penetration at the head of the run, but the lower portion of the field should also be checked to see that it is receiving enough moisture. The use of exceptionally long runs is another fault that should be checked. A run of 1,000 to 2,000 feet will usually result in poor distribution of moisture with an over-supply near the head and very little at the foot. Shorter runs under most conditions will permit better control and prevent leaching near the head ditch and save considerable time and money in the application.

In attempting to secure more even distribution of irrigation water and better control, the size and placement of ditches and the use of siphons or other pipes that give individual control of each furrow should be considered.

Regardless of the methods selected by the grower, he is attempting to obtain the same results, and only by careful control and constant checking will the desired results be accomplished. Penetration should be checked after each irrigation, and flooding around the crown of the beets should be reduced to a minimum. Leaching of plant food by application of too much water is costly in loss of plant nutrients, and also increases irrigation costs unnecessarily. Proper timing of the applications is also important, so that the beet never suffers from lack of water or too much water and will continue a constant development.

Growers should select the methods best suited to their own particular farm and not depend on the common practices of the community to decide for them. In irrigation, these facts should be kept in mind:

1. The type of soil being irrigated, both the surface and sub-surface.
2. That levelling will improve any method of irrigation and eliminate many problems.
3. That the crop needs water, and only by watching its growth and determining the soil moisture can a good idea of the crop's demand be obtained.

SHEARED SEED PLANTING TRIALS

By W. B. MARCUM, *Agricultural Department*
Spreckels Sugar Company

Since the announcement of the development of sheared seed in the January Spreckels Sugar Beet Bulletin, many growers have requested further information. Trials are now being conducted to gain field experience as to its adaptability for commercial use.

Shearing operations include the removal of some of the cortical tissue surrounding the seed germs and a segmentation of the seed ball so that each seed particle remaining contains a single germ. (See Figure 1.) Segmentation has produced seed which grades to a small size, with about 85 per cent of the seed pieces containing single germs of a high germination.

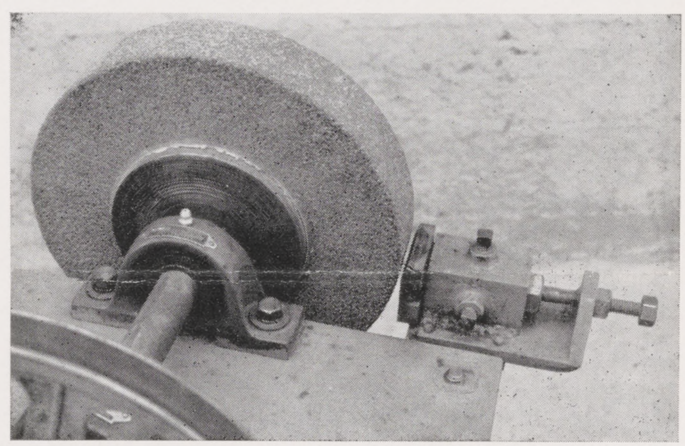

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Fig. 1.—Abrasive wheel and adjustable shear block of segmenting machine to produce sheared seed.
Courtesy of Mr. S. W. McBirney, U. S. D. A.

Plantings of this seed are being made with standard John Deere plate planters, using 72-hole plates, each hole being 3/16″ in size. (See Figure 2.) These plates can be used in John Deere planter models No. 18, zz, 32, and 55. The highest seeding rate now being obtained is 6 pounds per acre with an average spacing of approximately 1½ inch. All seed used in the tests being conducted by the Spreckels Sugar Company has been treated with 2 per cent Ceresan at the rate of 1½ pounds per 100 pounds of seed.

In order to gain a wide variety of conditions for testing

the sheared seed, a 6-row planter has been equipped with the necessary plates by the Spreckels Sugar Company and this planter is transported to various parts of the district. In addition, extra cans are available which can be set on planters in place of the seed cans used on standard equipment. It is suggested that growers wishing to make

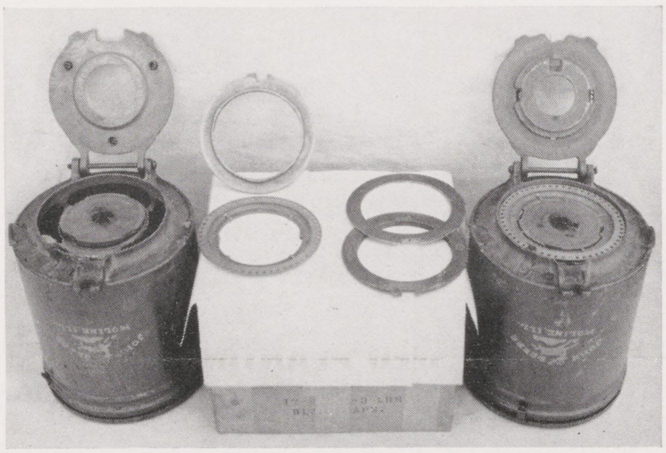

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Fig. 2.—Can and special plates adapted for sheared seed planting on standard equipment.
Courtesy of Mr. S. W. McBirney, U. S. D. A.

trial plantings of this seed contact the field superintendent in their district.

It is yet too soon to determine what kind of stands are obtainable with sheared seed plantings under varying conditions. If satisfactory stands can be obtained, a large quantity of seed will be available for next year's plantings.

THE SUGAR SHORTAGE

FACTS BEHIND THE HEADLINES

Prepared by UNITED STATES BEET SUGAR ASSOCIATION

Interesting questions are raised by Government estimates that sugar beets grown in the United States will be the most important single source of sugar supply for American consumers in 1942.

Within the next few weeks millions of American housewives will march into the schools of the nation to apply for sugar-ration cards. Thereafter, perhaps for the duration of the war, they will be unable to purchase sugar except upon presentation of stamps — and the limited amounts of their purchases will be rigidly controlled by the Office of Price Administration.

Rationing of sugar has been decreed because a shortage of supplies makes it necessary, first, to make certain that all military requirements for sugar and molasses are fulfilled, and, second, that the remaining sugar is fairly distributed among civilian consumers. The present shortage of sugar, and thus the need for rationing, results from these facts:

1. Consumption of sugar in the United States in 1941 reached the enormous total of nearly 8,000,000 tons, at least 1,000,000 tons more than normal. Reserve stocks, as a consequence, were seriously reduced.

2. Shipments of sugar from the Philippine Islands, ordinarily amounting to 1,000,000 tons a year, have been entirely cut off by the war. It is likely, moreover, that Hawaii and other off-shore areas of supply will find it impossible to send their usual volume of sugar to the mainland because of shipping difficulties.

3. The United States is committed to make large stocks of sugar available to the United Nations, chiefly Great Britain, Canada, and Russia.

4. A substantial part of the Cuban crop, recently purchased by the Defense Supplies Corporation, must be converted into molasses for the production of alcohol. In war, alcohol is indispensable. It furnishes motive power for torpedoes, it is used as a solvent in making gelatine dynamite and smokeless powder, and as a dehydrating agent in the production of nitrocellulose.

The Office of Price Administration has prepared the following table, which shows the sources from which the United States received its sugar in 1941, and makes a "conservative estimate" of the amounts of sugar which we can obtain from the same sources in 1942:

AREA	Supply in 1941	Estimated for 1942
	Short Tons	
Domestic beet sugar	1,940,000	1,750,000*
Domestic cane sugar	408,000	450,000
Philippines	854,000	None
Hawaii	903,000	500,000
Puerto Rico	993,000	1,100,000
Virgin Islands	5,000	5,000
Cuba	2,696,000	1,070,000
Other Foreign Countries	190,000	35,000
Miscellaneous (frozen stocks, etc.)	None	390,000
Totals	7,989,000	5,300,000

*The estimated beet sugar supply for 1942 reflects reduced production from restricted acreage in 1941.

"These facts mean," according to Leon Henderson, Administrator of the Office of Price Administration, "that both over-all industrial and household uses of sugar must be cut about one-third below the very high per capita totals reached in 1941 . . . At the present time it appears that household consumption will have to be reduced from about 74 pounds per capita in 1941 to around 50 pounds in 1942, and that consumption in industry will have to be reduced from 40 pounds per capita in 1941 to 27 pounds in 1942."

The foregoing statement means that the beet sugar industry of the United States will for the first time become the most important single source of supply for American consumers. The supply of beet sugar for 1942 — 3,500,000,000 pounds — is subject to none of the hazards of ocean shipping. Always available for distribution, the stocks of beet sugar form a cushion which has already eased the severity of the rationing program, and will continue to do so in the future.

One of the most efficient converters of solar energy known to science, the sugar beet produces more food per acre, in concentrated sugar and meat, than any crop extensively grown in the Temperate Zone. Beet sugar is produced in 27 countries. Heaviest emphasis on beet culture is in areas where the problem of supplying maximum food per acre is most critical. Before invasion, Russia produced more beet sugar than any country in the world. Germany is second. The United States is third with 100,000 sugar beet farmers in 19 states, served by 85 processing factories.

Importance of the sugar beet cannot be appraised in terms of sugar alone. After the sugar has been extracted, the beet by-products consisting of pulp, top foliage, and molasses, are fed to livestock with farm-grown hay and grain. The beet rotation enables the farmer to market his entire diversified output in the form of concentrated sugar and meat, and restore animal waste products to the soil, enriching his entire farm. By-products alone of the sugar beet produce more meat than the entire product of an average acre of corn.

HONOR ROLL FOR 1941

Growers producing an average yield of sugar beets grown under contract in 1941 in excess of 25 tons per acre are shown on the list below.

ACREAGE AND AVERAGE YIELDS LISTED BY CONTRACTS

GROWER	Harvested Acres	Tons Beets Per Acre	Lbs. Sugar Per Acre
Glenn West	25.9	32.49	10,849
John A. Robertson	9.4	29.75	10,556
Obata Bros.	18.7	32.99	10,540
H. B. Hayden	2.1	32.88	10,473
Mrs. M. Wilmot	33.0	28.24	10,448
A. L. Gerhart	25.6	30.08	10,261
J. G. Marinovich	24.0	29.22	10,235
Geo. H. Clever	35.0	29.53	10,212
Curly Top Res. Breeding Com.	6.7	30.25	10,201
Paul B. Tavernetti	18.2	28.30	10,165
F. A. Fields	9.0	30.77	10,136
Tognetti Bros.	35.7	29.67	9,908
J. A. West & Son	28.8	29.60	9,889
J. G. Marinovich	29.1	27.69	9,868
Tom Obata	6.1	29.60	9,834
Mrs. L. Verzasconi	17.3	29.85	9,831
T. Yoshioka	19.9	25.12	9,742
H. C. & R. E. Lauppe	9.0	33.59	9,734
Sciaroni & Albertoni	18.0	29.62	9,722
J. J. King	67.8	27.24	9,628
Joe Jacinto	11.6	28.50	9,612
Paul Hanson	26.7	25.93	9,600
Fausto Morisoli	16.8	25.65	9,599
Irvin Dethlefsen	13.7	26.61	9,592
Thos. Chesholm Farms	28.8	25.20	9,589
J. S. & L. Tamagni	29.1	26.29	9,548
S. Ishimoto	23.0	28.48	9,544
McFadden Bros.	124.6	26.24	9,454
Richard Alcock	15.0	29.36	9,434
T. W. Chung	10.2	29.10	9,362
I. Yamaguchi	7.5	26.89	9,313
Clarence Vosti	6.0	25.64	9,307
W. T. Bramers	10.7	26.23	9,301
Fred Vosti	30.4	27.20	9,284
James Koeber	21.0	27.88	9,278
Helen M. Hanson	31.8	27.44	9,275
Irvin Petz	23.3	25.23	9,215
J. G. Marinovich	65.0	26.01	9,207
Albert Ikeda	6.9	25.09	9,192
Frank V. Frates	140.0	25.04	9,063
B. F. Wynne	26.9	25.00	8,962
Davini & Parenti	121.9	26.38	8,942
Emanuel Heubach	8.0	29.14	8,942
Geo. R. Patterson	65.6	25.90	8,882
Richard Moore	20.0	26.62	8,874
Botelho Bros.	10.9	26.89	8,848
Geo. Martella	38.0	28.31	8,815
Thos. Nunes, Jr.	66.1	25.36	8,794
T. R. Merrill	13.5	27.50	8,755
John E. Jackson	6.4	27.56	8,733
T. H. Holthouse	64.5	25.21	8,582
M. F. West	28.3	25.59	8,574
Tognetti Bros.	31.6	26.01	8,568
Richard Moore	36.0	25.66	8,562
Otto Strehle	16.0	25.27	8,364
Leo Wetzel	56.0	27.35	8,357
T. H. Holthouse	10.3	25.15	8,341
C. Taguni	10.0	25.46	8,193
J. A. Smith	37.9	25.81	8,164
Henry Guidotti	29.7	26.07	8,154
John A. Robertson	5.3	28.22	8,115
Morris R. Giguiere	40.0	27.71	7,950
Elmer Andersen	6.0	26.36	7,922
T. R. Merrill	11.6	25.94	7,911
Yone Kojima	5.0	25.58	7,836
Richard Alcock	9.3	25.11	7,803
Richard Alcock	5.2	25.14	7,771
S. & D. M. Biancucci	87.0	25.38	7,735
D. P. & D. E. Wilson	13.5	26.79	7,733
B. E. Lundholm	19.7	25.13	7,682
B. E. Lundholm	18.5	25.09	7,645
Sears Bros. & Co.	15.0	25.36	7,528
G. A. Bender	14.73	25.01	7,498
Lowe, Reiff & Burger Bros.	64.3	26.47	7,228
Fred Rominger	6.0	26.42	7,202
Arthur Ripkin	102.4	26.73	7,187
Ralph Pollock	73.0	25.09	6,815

1942 IRRIGATION PROGRAM NOW UNDER WAY

By F. J. HILLS, *Agricultural Department Spreckels Sugar Company*

One of the big problems of irrigation is to know when and how much water to apply. Often, much more water than is necessary is applied, resulting in needlessly high costs and in some cases, damage to the crop. Also, many times a crop may be retarded in its growth because of the lack of needed water.

With this problem in mind, the Spreckels Sugar Company has for the past five years carried on an intensive irrigation program to assist growers with their irrigation problems and practices.

Considerable preliminary work must be completed before any practical information on when to irrigate and how much water to apply can be furnished.

A crew of men spends about three months each season traveling throughout the district taking soil samples and making penetration studies. Several locations are selected in each beet field from which soil samples are taken. The locations are scattered so as to determine the variability in soil texture throughout the field. Soil texture variability is important as it is desirable to be able to point out the areas that may require more or less water.

Two soil samples are taken from each location: one from 6 to 30 inches below the surface, and one from 30 to 54 inches. In the laboratories, the moisture equivalent (water-holding capacity) of the soil is determined. The moisture equivalent is the upper limit of soil moisture that is available to the plant. By taking one half of this moisture equivalent, a close approximation to the permanent wilting percentage is obtained. The latter is the lower limit of available soil moisture.

By taking additional soil samples from time to time throughout the growing season and having the moisture content determined, it is possible to decide when a field should be irrigated and whether a light or heavy application of water is necessary.

For the past two years, the Agricultural Department of Spreckels Sugar Company has been working on a new method of determining soil moisture. This method, utilizing the principle that soil moisture is directly correlated with resistance to an electrical current, has been developed by various research workers throughout the country and promises to have considerable practical application. If the necessary supplies can be obtained, it is planned to set a considerable number of these moisture testing units in the fields during 1942. Using this new method, a field man, having the necessary equipment, can

determine in a few minutes the moisture content of the soil. The determination of actual soil moisture by taking samples in conjunction with the electrical method will serve as a check on the new system. By correlating the two methods much helpful information can be obtained.

During the time that the irrigation program has been carried on much useful data have been collected. Approximately 50 per cent of the contracted acreage has been mapped and moisture equivalents have been determined on nearly that acreage. Each year brings more useful data and new improvements. Permanent information necessary for proper irrigation is gradually being developed which, it is hoped, will perform a valuable service to the sugar beet grower.

WILTING REDUCES SUGAR PRODUCTION

"When the plants showed definite wilting and the soil moisture was approximately at the wilting percentage, there was an 87-per cent reduction in both photosynthesis" (sugar production) "and transpiration."

These results were obtained at the Ohio Experiment Station in experiments on the "Influence of Soil Moisture on Photosynthesis, Respiration, and Transpiration of Apple Leaves."

Since the primary purpose of beet production is to obtain maximum photosynthesis in order to secure maximum sugar yields, it is obvious that to allow the plant to wilt because of insufficient soil moisture is a sure way of reducing yields.

Insufficient available moisture may be brought about either by the plant extracting water below the permanent wilting point or by the soil becoming saturated with water, that is, containing water above field capacity. It is, therefore, essential for maximum production that soil moisture be maintained between the permanent wilting point and field capacity.

FARM DITCHES (Continued from page 21)

to prevent erosion. Both types of structures are similar in design and appearance. Check gates, although extensively used in canal distribution systems, are not commonly used or required in most farm irrigation systems. Both check gates and drops must be so constructed that the turbulence and erosive action of the water below the structure will not undermine it and cause failure.

In addition to these larger structures, large numbers of small structures including "furrow tubes" and "syphons" for admitting water into furrows are used. Furrow tubes are made from wood lath or slats, from specially milled sections of redwood, from galvanized iron, from old pipe, or from short sections of hose. Discarded air brake hose from railroad cars have been found very serviceable for this purpose. Small siphons, made from galvanized iron, make possible the regulation of water into furrows without cutting through the ditch bank.

Farm ditches also require a few structures for crossings at farm roads, or points of access into the field. For small ditches, culverts are generally used, and for the large ditches, bridges may be used. Culverts may be made from wood, corrugated iron, or concrete pipe. Concrete pipe is probably the most satisfactory from the standpoint of cost and durability. To avoid breakage under heavy loads it should be buried as deeply as ditch conditions will permit, preferably up to about 2 feet of cover. This will often necessitate some type of inlet and outlet structure at the ends, and the structure as a whole will form an inverted siphon. Where exceptionally heavy truck loads are to be carried, reinforced concrete culvert pipe, or corrugated pipe should be used. For temporary crossings, culverts made from 2-inch planks may be less expensive.

From the standpoint of hydraulics, all gate structures fall into two classes: overpour and undershot types. When water flows through an open rectangular notch, the flow will vary approximately as the three halves power of the depth. When flowing through a submerged opening the flow will vary as the square root (one-half power) of the difference in water level upstream and downstream from the gate. If the aim is to maintain an approximately constant water level upstream from the structure, an overflow opening is much better than a submerged gate. For check gates and drops, therefore, the overflow type is more satisfactory. Where the aim is to admit a part of the flow into another ditch or to the field, a submerged opening is preferable. This type will minimize the variation in amount diverted when there are changes in water level in the supply ditch. For most side diversions, therefore, an undershot gate is better. For places requiring a gate either closed, or completely open, either type would suffice, but structures with undershot gates are generally more nearly watertight than overflow structures with flashboards.

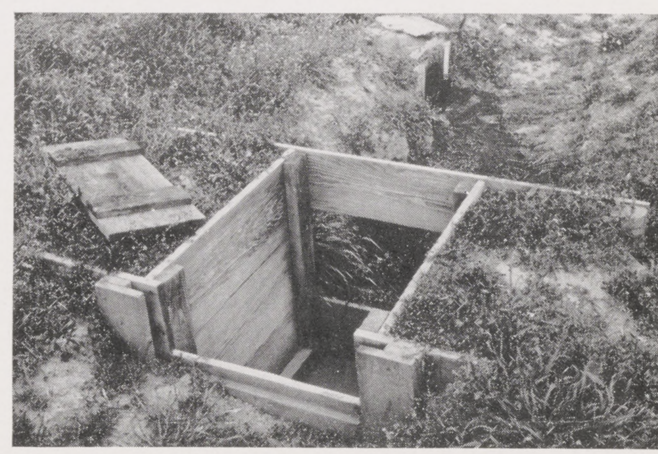

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Fig. 3.—Combination double wing wall stop gate and crop. Note that floor level is about 8 inches below the bottom of the ditch downstream from the structure.

Keeping these principles in mind let us consider specific types of structures suitable for farm ditches. Wooden gates are extensively used. They are fairly inexpensive and can be built in any size desired. The principal objections to wooden structures are their relatively short life due to decay, and possibility of loss due to fire. The most satisfactory material for wooden irrigation structures is heart redwood. The life of Douglas Fir, and other soft woods, is materially increased if it is treated with a preservative such as creosote. Very often, old lumber discarded from other uses, can be utilized to advantage in building irrigation structures.

Several types of wooden structures may be considered. For "field gates," for admitting water to the field, single wall wooden gates, of the type shown in figure 1 are fairly satisfactory. To avoid excessive erosion downstream from

(Continued on page 28)

FARM DITCHES *(Continued from page 27)*

the structure two precautions should be taken; first, make the opening below the normal water level of such size that the mean velocity through the opening is not more than about 2 feet per second; next, place the gate sill about 6 inches below the normal ground level downstream from the structure. Consider such a gate for a flow of 3 cubic feet per second. Assume the top of the gate to be 6 inches above the water level and 1 foot above the ground level.

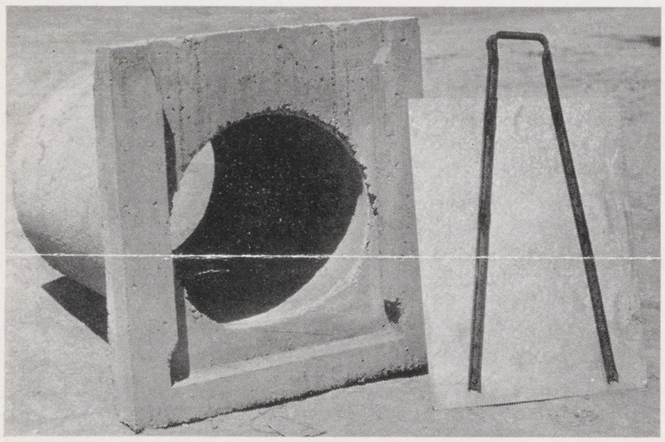

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Fig. 4.—Concrete pipe type field gate, with precast headwall and sheet metal gate. Variations of this type include those with headwalls that slope back. Sheet metal guides for the gate are often used.

The gate opening must then be about 18 inches high, and to contain an area of 1.5 square feet below the water level, it should have a net width of at least 18 inches. The length of the wing walls should be about twice the height of the opening. Structures of this type have been made with openings up to 8 feet or more in width; for openings more than 4 feet in width, a center support for the gate is provided. The top 2 x 4 tie is an important part of the structure; it ties the two sides of the structures together, and insures that the gate will fit in the guides. A similar type of single wall structure, without the top tie, has not proved satisfactory because of this weakness.

Several variations of this type of structure are possible. Sometimes an apron is constructed on the downstream side to absorb the impact of the falling water and prevent erosion and undermining of the structure. This is especially important when the gate is used on ditches constructed in fill, so that the sill must be placed higher than the ground level on the downstream side. Another variation involves the use of short side boards at the sides of the opening which make it possible for the earth to be packed up close to the opening. This type of structure is illustrated in figure 2. This reduces the required length of the wing walls to about 1 or 1½ times the height of the opening.

For stop gates, and check gates, especially in sandy soils that are readily eroded, a double wing wall structure is more satisfactory. These structures have upstream and downstream headwalls tied together with a rectangular flume section which is generally from 3 to 5 feet long. They are generally built with a 2″ x 4″ frame covered with 1″ lumber. An illustration of a combination stop gate and drop is shown in figure 3. Where possible, the lumber should be on the earth side of all supporting members. To prevent undermining it is generally necessary to install, and carefully backfill the structure before placing the floor of the apron, or flume section, downstream from the gate. This apron should be about 6 inches below the bottom of the ditch grade downstream. A low sill with the top at approximately ditch grade at the downstream end of the apron is desirable, especially for checks or drops where there is an appreciable drop in water level passing through the structure. The wing walls need not be as long as for single wall structures; their length is often less than the height of the opening, but will depend upon the width of the ditch, as they should extend well out into the banks.

Concrete structures are of two types, the poured in place structure, which should preferably be reinforced with steel, and precast structures, usually made partly from concrete pipe. The former type are extensively used in some parts of San Joaquin Valley where large irrigation streams of 10 cubic feet per second or more are used. For ordinary conditions where the size of irrigating streams vary from 1 to 5 cubic feet per second, the concrete pipe type is less expensive and quite satisfactory, especially for field gates. A common type is shown in figure 4. It consists of a short length of concrete pipe with a thin precast headwall, and a sheet metal slide gate. A similar type of structure is also made with a thin concrete gate that is moved sideways to open and close. Sometimes, a length of concrete or vitrified clay sewer pipe with bell end is used as a field gate, as shown in figure 5. A wooden disk,

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Fig. 5.—Field gate made from length of vitrified clay sewer pipe with wooden disk used as gate. Concrete pipe is often used.

cut to fit the bell of the pipe, is used as a gate. These pipe structures are economical, costing very little if any more than wooden structures of similar capacity, and they are durable. For ordinary conditions the following capacities based on a velocity of 3 feet per second, may be assumed: 8-inch diameter, 1 cu. ft. per sec.; 10-in., 1.6 c.f.s.; 12-in., 2.4 c.f.s.; 14-in., 3.2 c.f.s.; 16-in., 4.2 c.f.s.; 18-in., 5.3 c.f.s.; 20-in., 6.6 c.f.s.; and 24-in., 9.5 c.f.s. Where the available head is ample, the capacities may appreciably exceed these amounts.

In addition to wood and concrete structures, galvanized sheet metal structures, and sheet metal and cast iron gates for use with concrete structures or galvanized iron culverts, are available. Most of this equipment is very satisfactory, but may be somewhat more expensive than the concrete and wooden structures already described.

Spreckels SUGAR BEET Bulletin

PUBLISHED FOR CALIFORNIA SUGAR BEET GROWERS BY THE SPRECKELS SUGAR COMPANY

VOL. VI MAY 1942 No. 5

IRRIGATION OF SUGAR BEETS BY SPRINKLING

By J. E. CHRISTIANSEN
University of California, Davis

In some sections of Central California sprinkling has become an established method of irrigating sugar beets. The first portable sprinkler systems were used for irrigating beets in the Clarksburg district in 1932. The method gained in popularity very rapidly, and within a few years nearly all of the beet growers in that district were using sprinklers. Most of these original users are still using the sprinkling method. The method spread gradually to other areas, and a few years later sprinkler systems were a very common sight in Sutter Basin and farther north in Sacramento Valley.

After ten years' experience, one can now look back and appraise sprinkling as a method of irrigation, and compare it with other methods in use in these same areas. During the first few years it was difficult to do this. Owners were generally enthusiastic, as they usually are, over any new piece of farm equipment. They were hesitant about admitting disadvantages of sprinkling, and it was only after a period of several years that one began to hear many complaints.

Let us consider just what sprinkling can and cannot do. It is a method of irrigation, the purpose of which is to apply water to the field in such quantities as can be stored in the soil within the rooting depth of the crop for subsequent use by the growing plants. Uniformity of application is desirable, as it minimizes waste of water, and detrimental effects of inadequate amounts in some spots and excessive amounts in other places. With good sprinkling equipment, properly operated, a fairly uniform application can be applied probably better than can be achieved by surface irrigation, except where the land is exceptionally well graded. The control over the water is excellent; one can apply as little or as much as he pleases, as long as he doesn't apply so much that it becomes impossible to get on the ground and move the pipe afterward. In other words, it is possible to do a good job of irrigation with a sprinkler system.

Not all sprinkler systems give satisfactory results, however. Many of the systems in use are doing a very poor job because of poor equipment, improper methods of operation, or a lack of appreciation of just what should be accomplished. Troublesome sprinklers that will not rotate at a slow, uniform speed are very common. Inefficient layouts; long lines, in which the friction loss (drop in pressure) is excessive, result in inadequate pressure for proper sprinkler performance, or excessive power costs for pumping against unnecessarily high pressures. The lack of an understanding of the moisture-holding ability of the soil, and of the amount of water required for crop production, is very often evident. Very light applications, that penetrate to a depth of only a foot or two, is one of the common mistakes. Studies indicate that beets growing in deep alluvial soils, not affected by a high water table, will extract moisture from depths of more than 6 feet, and will show no signs of distress, and no interruption in growth, until most of the soil to that depth is dried to the permanent wilting percentage. For such soils, there is no advantage in applying light applications. Two or three fairly heavy applications insure penetration of water to the desired depth, and produce the highest yields. In order to obtain adequate penetration with light applications it is neces-

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Typical portable sprinkler system in operation in the vicinity of Clarksburg.

sary to irrigate while the soil still contains a large amount of available moisture. When the subsoil is once dried out it can be wetted again only by applying water in sufficient amounts to raise the moisture content of all of the soil above it to the field capacity. This requires applications of from ½ inch of water per foot depth of soil for coarse-textured sandy soils, to as much as 1½ inches per foot depth for fine-textured clay soils.

(Continued on page 34)

RELATIONSHIP OF IRRIGATION TO FERTILIZATION

By L. D. DONEEN, *Irrigation Division*
University of California, Davis, California

This article will discuss some of the interrelated factors of irrigation and fertility of the soil for maximum sugar beet production. For example, the soil may be supplied with adequate moisture but the fertility may be so low that the growth of sugar beets is limited by this condition, or the reverse may be true, where adequate soil fertility occurs or is maintained but an inadequate irrigation program is followed.

Every soil has a certain amount of natural fertility built up in past geological ages in the formation of the soil, which we cannot change materially. Most of the nutri-

(Continued on page 32)

WATER GRASS AND SUGAR BEETS

By W. W. ROBBINS
University of California, Davis

The cultural practices employed in growing sugar beets are favorable for the spread of watergrass, and in such a crop the losses often are heavy because of the weed's presence. Watergrass is an introduction from Europe and is now generally distributed throughout the entire United States. It is an annual plant, reproducing by means of seeds alone; but it is a prolific seeder—it has been estimated that a single plant may produce as many as 40,000 seeds.

In the sugar beet crop, watergrass usually does not give trouble until late in the summer. In the first place, seed germination does not occur at its maximum rate until midsummer, and secondly, such plants as do appear in early season are readily destroyed by the usual cultivations and hoeings which the crop secured. But if there is an abundance of watergrass seed in the soil, as soon as the crop is laid by, the weed grows very rapidly and may seriously reduce yields and retard harvesting operations. The cost of hoeing watergrass in a sugar beet crop which is too far advanced to cultivate may be excessive and the operation may be of doubtful economic gain.

We have seen sugar beet fields which have been laid by unnecessarily early, possibly with a view of reducing cultivation costs, and in such fields watergrass developed rapidly, and seriously smothered the sugar beets. If watergrass threatens, it is well to cultivate as late in the season as the crop will stand. One more late cultivation may eliminate a large percentage of the watergrass, increase yields, and reduce greatly late hoeing costs.

There is no chemical spray that can be successfully employed to destroy watergrass that will not injure sugar beets.

If land is heavily infested with watergrass, and the weed in any one season matures a crop of seed and shatters this on the soil, it is inadvisable to follow with a beet crop or one similar to it. Rather it is well to place the land in a crop whose habits of growth and water requirements do not encourage the development of watergrass. Such a crop is barley or other small cereal, or a crop that attains maturity before midsummer. A grower should not attempt the growing of sugar beets year after year on land that is infested with watergrass. As a rule, crop rotation is the most reasonable and economical answer to the watergrass problem.

LABOR CAMP CONSTRUCTION

In order to meet the demand for large numbers of laborers for the 1942 season, many sugar beet growers are planning on providing additional camp facilities. To aid in this attempt by growers to secure suitable labor by having adequate housing facilities, the Spreckels Sugar Company has arranged to assist growers in the financing of the construction of these camps.

Considerable progress has been made in the construction of portable camps. Concerns are now available which will erect pre-fabricated camps. A ten-man unit consisting of two buildings, each 17x28x8 feet, will cost approximately $1,000. The buildings can be dismantled and moved to other locations very easily if this is desired. The buildings as constructed meet the requirements of the Immigration and Housing Commission and may offer a solution to the camp construction problems of certain growers.

Growers who may be interested in camp construction should contact their field superintendent immediately.

MANURE INCREASES PROFITS

By J. B. LARSEN, *Agricultural Department*
Spreckels Sugar Company

One field on Emil C. Meyer's lease at King City had given sufficiently poor results so that in the fall of 1940, Mr. Meyer decided to attempt to remedy the condition by making heavy applications of fertilizers. Five tons of cow manure per acre were applied to one portion of the field. Another portion was left as a check and received no manure. The ground was worked deeply, listed, and planted.

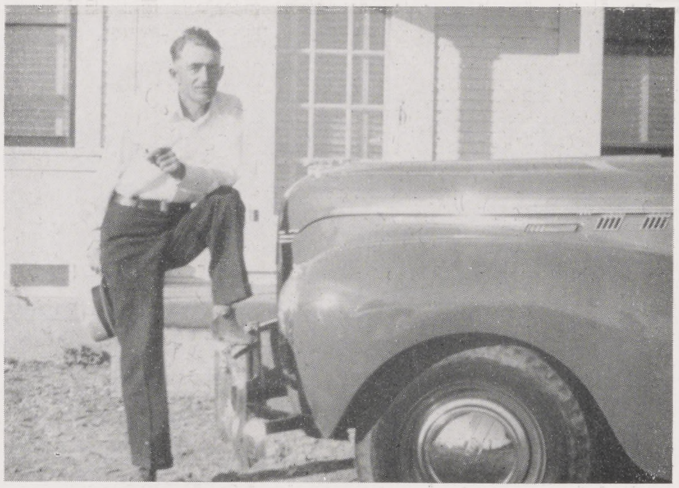
As soon as the beets were thinned, Mr. Meyer applied 350 pounds of ammonium sulphate per acre to each plot. The beets on the manured portion were larger when thinned and throughout the season made more rapid and vigorous growth than the unmanured portion. Although Mr. Meyer did not keep separate records of the hoeing costs of the two plots, he stated that hoeing expenses were approximately one-third less per acre on the manured plot because of increased foliage.

At harvest, the results of the two plots are as follows:

	Tons Per Acre	Sugar Percentage	Pounds Sugar Per Acre
Manure plot	20.7	19.0	7,866
Check plot	17.8	18.5	6,586

The harvest results showed that the plot receiving the manure yielded almost three tons of beets and 1,300 pounds of sugar per acre more than the check plot.

Even considering the cost of $2.25 per acre for the manure applied on the land, and estimating the additional cost of disking the manure into the ground and harvesting the increased tonnage, it is estimated that the use of manure resulted in a net profit of about $15.00 per acre in excess of the net return from the check plot.



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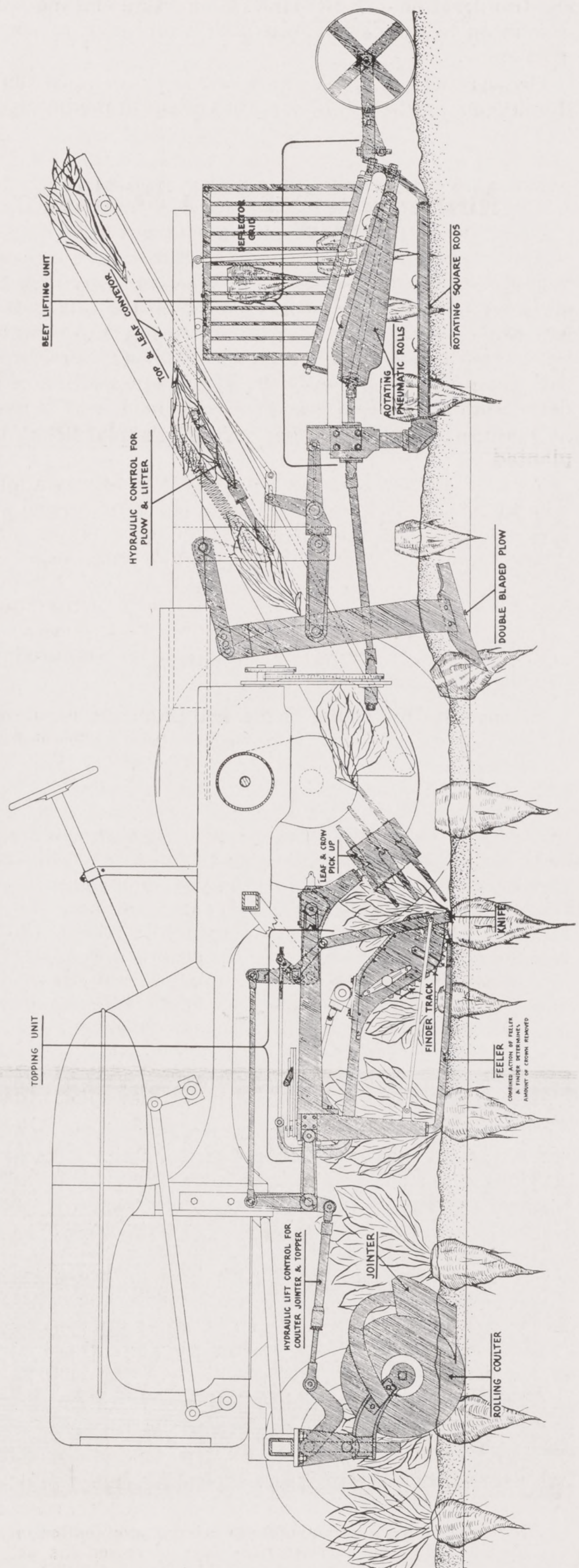
Manure and ammonium sulphate used in combination on Emil C. Meyer's ranch at King City increased the net returns $15 per acre over the use of ammonium sulphate alone.

MECHANICAL HARVESTING OF SUGAR BEETS SOON TO BE A REALITY



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The photograph above and the diagrammatic sketch at left show the latest improved beet harvesting unit mounted on a tractor. The beet topping device is hung directly under the tractor, while the device for lifting the beets out of the ground is attached to the rear. To top beets properly so as to minimize topping losses, use is made of a feeler to gauge diameter of the beet and to center the finder. The finder not only gauges the height of the beet above ground level but holds the beet in a vertical position as it is being topped. Tests to date indicate that the mechanical topping will be just as satisfactory as hand topping.

As soon as topped, a double-bladed plow loosens and slightly lifts the beet. Two rotating square rods, forming a "V," lift the beet from the clods by imparting a series of jerks to the beet as the machine travels forward. This lifts the beet sufficiently to permit it to be engaged between a pair of tapered pneumatic rollers, set directly above the rotating rods. These rollers, upon engagement of the beets, lift them free of the soil and throw them against a deflecting grid onto an elevator or conveyor leading to a bin or truck, as desired. A close-up of the beet lifter is shown in the photograph below.

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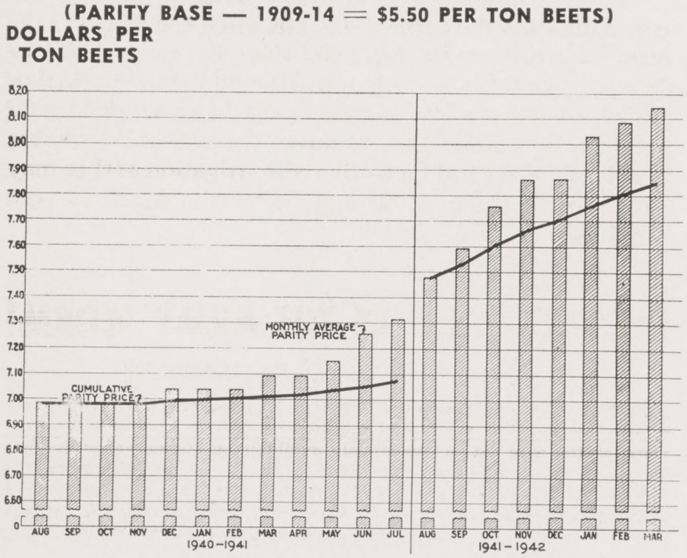
Photograph—courtesy of S. W. McBirney, U. S. Department of Agriculture

The development of this very necessary and highly important equipment is the result of the untiring efforts of the Division of Agricultural Engineering of the University of California, under the personal direction of its head, Professor H. B. Walker. Actively cooperating with Professor Walker and his staff were members of the staff of the United States Department of Agriculture. The United States Beet Sugar Association, an organization of processors in the western United States, cooperated both financially and in an advisory capacity.

MARCH PARITY PRICE OF SUGAR BEETS — $8.14

(PARITY BASE — 1909-14 = $5.50 PER TON BEETS)



RECRUITING OF FIELD LABOR

By J. E. COKE, *General Agriculturist*
Spreckels Sugar Company

Following is a brief resumé of activities which are under way at the date of this writing, April 14, to attempt to relieve the labor shortage for the 1942 crop of sugar beets. It is hoped that by the time this Bulletin is received a definite program of obtaining labor supplies will have been perfected.

For the last six weeks the sugar processors and the beet growers' association in California have been attempting to clear the way for the importation of Mexican labor from Mexico. An application to import this labor has been filed with the Bureau of Immigration and Naturalization and many meetings and conferences have been held with various state and federal agencies which have more or less jurisdiction over the movement of labor so that the necessary clearance might be worked out.

At the present time Mr. Gordon Lyons, Secretary of the Central California Beet Growers' Association, is in Washington, D. C., attempting to clear our application through the various departments of the government. The progress to date is very encouraging.

Another group, embracing the beet sugar, cotton, vegetable, citrus, deciduous fruits, and wine grapes in California, is also working on the same problem, and although less progress has been made within this group, it is expected that it may be considerable assistance later in securing the relaxation of immigration regulations.

Sugar companies outside California have already started recruiting Mexican labor within this state. It is hoped that plans now being worked out may make it possible to utilize alien labor, evacuated from the coastal zones, in the areas in which these sugar companies operate, so that they will not continue to recruit their labor supplies from this state. Strong efforts in this regard are now being carried on.

RELATIONSHIP OF IRRIGATION (Continued from page 29)

tional elements in the soil, other than nitrogen, have been derived from the original rock and are made available to the plant by the decomposition of this rock to soil. Nitrogen of the soil does not occur in any quantity in the original rock but is accumulated by plant material which during past ages was returned to the soil and underwent decomposition, liberating nitrogen in a form usable by the plant. As this material was not all decomposed in a single season, it gradually accumulated in the soil and is known as the organic matter of the soil. As the organic matter in the soil is decomposed, other elements than nitrogen are liberated and may be used in plant growth. However, the plant is not entirely dependent on these elements, as it can also obtain them from the rock fragments making up the soil. The sugar beet plant is dependent almost entirely upon the decomposition of the organic matter for its nitrogen—this nitrogen is usually stored in the soil in the form of nitrate nitrogen and very little, if any, in the form of ammonia. It is probable that when the soil is dry (at or below the permanent wilting percentage, i. e., the moisture percentage in the soil too low to be readily available to the plant) the rate of decomposition of the organic matter is greatly reduced or inhibited by the low moisture content. Many experiments with sugar beets and other crops show that the yield and quality are not affected by various soil moisture conditions, and indicate that the nitrogen availability to the crop is not materially affected in the range of readily available soil moisture, provided sufficient moisture is maintained to prevent wilting, and excess water is not applied to cause leaching below the area of root development. An experiment conducted in the past year with sugar beets, in which soil moisture was allowed to fluctuate through varying degrees of availability, further substantiates the fact that soil moisture does not materially influence the availability of nitrogen to the plant. The sugar beets in all treatments of the above experiment were able to obtain approximately 250 lbs. of nitrogen from the soil. At the time of thinning, approximately 95 lbs. of nitrogen were available in the soil as nitrates. This had accumulated from the decomposition of organic matter during the winter and spring. The other 155 lbs. of nitrogen were from decomposition of organic matter during the growing period of sugar beets and were not influenced by varying soil moisture conditions. The soil in this experiment was not fertilized.

The three main fertilizers in use are: nitrogen, phosphorus, and potassium. Results do not definitely show that crop responses can be obtained from phosphorus and potassium in most sugar beet growing sections of Northern California. Therefore, the following discussion will be concerned with the nitrogen fertilizers. From the article by W. R. Schoonover in the March issue of the Spreckels Sugar Beet Bulletin, Vol. VI, No. 3, it is evident that due to the war, most of the nitrogen fertilizer will be of three types: ammonium sulfate, sodium nitrate and anhydrous ammonia.

The irrigation program in relation to fertilizer practice is somewhat complicated, as the various nitrogen fertilizers have different properties. A fertilizer in the nitrate form, as sodium nitrate, is readily soluble in the soil moisture and is immediately available for plant use, and can be easily leached below the depth of rooting by excessive rains or over-irrigation. For this reason it is best not to apply the nitrate fertilizer in the winter or before most of

the winter rains are over; also applying heavy and frequent irrigations will have a tendency to leach the fertilizer below the depth of rooting. The fertilizer in the form of ammonia (ammonium sulfate and anhydrous ammonia) is soluble in water, but when it comes in contact with the soil it is affixed to the soil and the nitrogen is not movable as ammonia, consequently leaching does not occur. After the ammonia is in contact with the soil for about two weeks, an appreciable quantity will be changed to nitrates and by the end of a month most of it will be in this form, which then may be leached by rain or irrigation water.

Because of the fixing power of the soil for ammonia, fertilizers in this form can be applied under conditions where nitrate-nitrogen might be leached from the surface layer of the soil. This makes ammonia fertilizers applicable to winter use or applied with early planting of sugar beets, as the ammonia fertilizers will be fixed in the surface few inches, and will not be moved downward until it has been changed to the nitrate form. At this time of the year this change occurs slowly because of the prevailing cool soil temperatures. This fertilizer can be broadcast or drilled into the soil. After the sugar beets are established the fertilizer can be drilled between the rows two or three weeks before the first irrigation, so that it will be changed to the nitrate form and leached into the root area by this irrigation. Investigation indicates that when ammonium sulfate or anhydrous ammonia is dissolved in the irrigation water its uniformity of application is about the same as that of water, but practically all of the ammonia will be located in the surface 2 or 3 inches. Thus, where penetration of water is 2 feet in one place in a furrow and 4 feet in another, the quantity of ammonia will be twice as much in the surface soil at the 4-foot penetration as compared with the 2-foot penetration. In general, roots of plants are capable of utilizing nitrogen in the ammonia form, but because of the high temperature of surface soil and the rapid loss of water by direct evaporation, there are not many roots in this area of soil, and consequently the nitrogen is not obtained by the plant until after the following irrigation, when it is leached to a lower depth in the nitrate form. Hence, ammonia fertilizers are considered slow in producing a response in plant growth, whereas the nitrates are immediately available when applied and the plant response to the fertilization may be rapid. However, for the entire growing season the ammonium nitrogen is just as efficient in producing growth as the nitrate form.

The placement of nitrogeneous fertilizers is of questionable value. This is not necessarily true of the other fertilizers, such as phosphorus or potassium, which are fixed more or less permanently in a soil in an unavailable form. Therefore, by placing these fertilizers deep in the soil in bands, the fertilizers will be concentrated and will not all be fixed by the soil. The placement of nitrogenous fertilizers is not important, as they are equally available to the plant in all proportions except for temporary fixation of ammonia as noted above. The plant usually does not show a deficiency until all the available nitrogen in the soil has been utilized; therefore band concentration is not so important.

The decomposition of manures and other organic fertilizers will be gradual, and probably will take place over a wide range of soil moistures, as occurs with the natural organic matter in the soil.

Nitrogen in the form of protein or organic matter is not leachable from the surface soil, but when converted to the nitrate form, it can be removed below the depth of rooting by excessive rains or irrigation. After winters of normal or heavy rainfall, the first irrigation should be withheld until the sugar beet plants have removed the available moisture to a depth of several feet, otherwise irrigation earlier may cause the leaching of nitrates below the depth of root penetration.

DECLARE WAR ON THE ARMY WORM!

By E. A. SCHWING, *Entomologist*

Editor's Note: To control army worms it is necessary to start poisoning them when they first make their appearance. Because materials for army worm control may not be immediately available on the market at the time they are needed by growers, the Spreckels Sugar Company has purchased and is holding in reserve a supply of Cryolite. Any grower, therefore, having difficulty in securing material should not delay control operations, but should immediately get in touch with the Field Superintendent in his district to purchase this material.

Sugar has become decidedly more important in our national economy since war was declared and so our efforts to protect sugar beets from such insect depredations as army worms must be intensified.

The battle of control against an insect of the character of the army worm is largely won if the farmer is prepared when the enemy first appears. It must be remembered that this dark gray moth that represents the adult flies and lays its eggs at night, not necessarily appearing in the same fields year after year.

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A knowledge of the army worm will be our best insurance of effectiveness against this pest. It winters over in the worm or pupal stage in undisturbed areas in fields, ditch banks or along fence rows. There are a number of forms of army worms to be found in the beet fields, but the treatment of all of them is similar. Usually the most common form in Northern California in the beet fields is a black worm with yellow stripes, known as the yellow-striped army worm. Other forms are green with black stripes and gray with dark stripes. The worms, when full grown, are roughly 1¼ to 1½ inches long. The army

(Continued on page 34)

ARMY WORM *(Continued from page 33)*

worms in California have three broods. The first brood hatches out in April, usually around the edges of the beet fields or on nearby areas on ditches. These first-brood worms do little damage to sugar beets, *but they should be watched and controlled,* if possible, as they produce a much larger second brood which does the damage to the beet crop. The first-brood worms grow to full size, pupate, then mature and mate. The female then flies over a much larger area to lay its eggs.

The second brood of worms appears in late June or early July. This is the brood that is numerous and does most of the damage to the crop. The numbers are sometimes so large that they will strip a field and will then march on to the next field. Often these worms will come out of an alfalfa field toward a beet field and will invade it like an army.

The third brood is usually small, as it has been cut down by predaceous insects and parasites. Hatching out in late August or early September, it is the brood that winters over. Sometimes this brood is numerous enough to seriously injure beans. It has been known to damage late-planted beets.

A careful watch for the first brood of worms in late April or in early May controlled with Cryodust at the rate of 20 pounds of dust to the acre or with a grasshopper bran mash at the rate of 20 pounds per acre is effective. To control the second brood most efficiently, watch for the work of the worms in the early morning and treat the fields while the worms are small.

We cannot emphasize this portion of the control effort too much. *Treat the beets while the worms are small.* Cryodust proved most effective during 1941. If the spray method is to be successful, use 4 pounds of paris green or 8 pounds of calcium arsenate per acre.

When worms are marching from one field to another, they can be stopped by the use of a ditch with a steep side and the use of crude oil in the ditch.

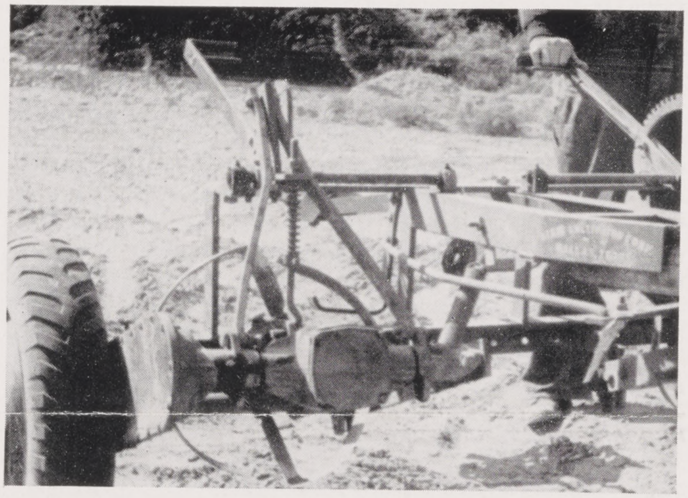
There cannot be too much emphasis on watching the fields. In several cases in 1941, whole fields were destroyed within several days. Remember, your local Spreckels Field Man is always ready and willing to assist you in providing materials and equipment to combat this menace.

THE DIXIE COTTON CHOPPER

By C. E. CRANE, *Agricultural Superintendent*
Spreckels Sugar Company

Interest in cross-blocking sugar beets has developed rapidly during the last few weeks. However, growers planting beets on ridges cannot cross-block with regular cultivating equipment as do those growers who plant beets on the flat.

In an attempt mechanically to block beets planted on ridges, the Spreckels Sugar Company purchased a machine, known as the Dixie Cotton Chopper, developed in Texas for blocking cotton. This machine is being tried extensively in the Salinas Valley and gives promise of being very successful. The machine is pulled down the row as in normal cultivation and the beets are blocked by a series of knives, which revolve on a shaft at right angles to the row. These revolving knives cut through the row of beets and they can be spaced to leave the width of block desired. Difficulty was experienced when the machine was first used in maintaining a uniform depth of cut because of variations in the height of the ridge on which the machine was working. This has been overcome by attaching a gauge wheel on the cutter. With the addition of this wheel, the machine is doing an excellent job of blocking.



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Dixie Cotton Chopper, showing one of the series of four knives used to block a single row of beets.

From experience gained thus far, the machine appears to offer at least one solution to mechanical blocking of beets planted on ridges.

In the operation of the machine it has geen gratifying to note that the edge of the beds has not been destroyed or pulled into the furrow, as is the case with hand thinning.

The use of this machine on fields which have been planted with sheared seed at low rates of planting should reduce to the minimum hand labor required in thinning operations.

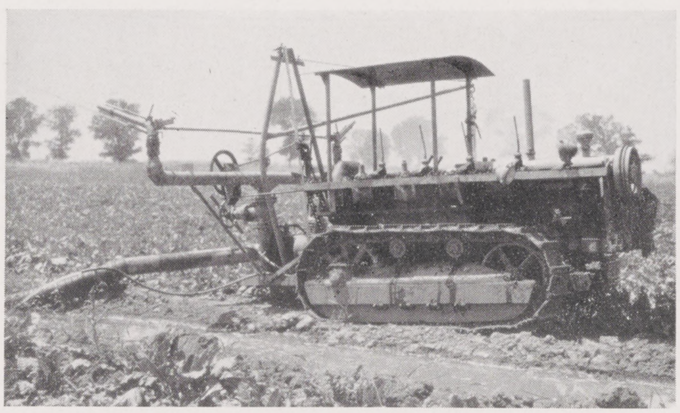
SPRINKLING *(Continued from page 29)*

In some places, however, the roots may not be active to depths of more than 3 or 4 feet because of the presence of very heavy subsoils, hard pans, or the presence of a high water table. Penetration of water only to the depth from which the roots extract water should be the aim of every irrigator. In other words, one should attempt to wet only the soil that has dried to some extent because of root activity; there is no point in adding more water to an already wet subsoil.

Frequent light applications result in higher losses by direct evaporation from the soil surface. During the summer the rate of evaporation loss from the soil is quite rapid, about ¼ inch per day, immediately after an irrigation, but as the surface dries, the rate decreases until it becomes negligible after a period of about two weeks, when the total loss may exceed an inch of water. It is, of course, much less under a heavy crop which shades the ground than on a bare field.

The presence of a water table within 2 to 4 feet of the surface is probably the principal reason why sprinkling has proved so successful in the Clarksburg and Sutter Basin areas. The upward movement of moisture from the water table supplies a part, sometimes a large part, of the moisture that is utilized by the crop, and evaporated from the ground surface. This reduces the amount that must be

applied to the surface to satisfy requirements. In some instances, seasonal applications of 10 to 15 inches have met all requirements, where under similar climatic conditions, but with the absence of a water table, about 24 inches of water would be required to prevent wilting. These light applications result in relatively lower costs per acre, and make it possible for sprinkler systems to cover much larger areas than they would otherwise be able to serve. On the other hand, a high water table concentrates the root activity in the surface soil, which dries rapidly, necessitating frequent irrigations to prevent wilting. Since only a foot or two of soil has to be wet, applications of 2 to 4 inches of water are ample, and heavier applications would only raise the water table. With surface irrigation, it is often difficult to apply these light applications successfully. The presence of the high water table, and difficulties in surface irrigation, have led to the practice of sub-irrigation, and before sprinkling was introduced this method was used exclusively in some places. Fundamentally, sub-irrigation is not a good practice. The water table must be kept quite near the surface, and the continuous upward movement of moisture tends to concentrate soluble salts in the surface soil. During a period of years of subnormal rainfall, ending about 1935, this condition became aggravated in some places, and possibly accounts in part for the sudden swing to sprinkling.



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Traveling sprinkler machine in operation near Knight's Landing. This machine moves continuously along the ditch at a speed of about 75 feet per hour. Two sprinklers discharge about 500 gallons per minute under pressure of about 60 pounds per square inch and effectively cover a strip 250 feet wide. The average application is about 2½ inches.

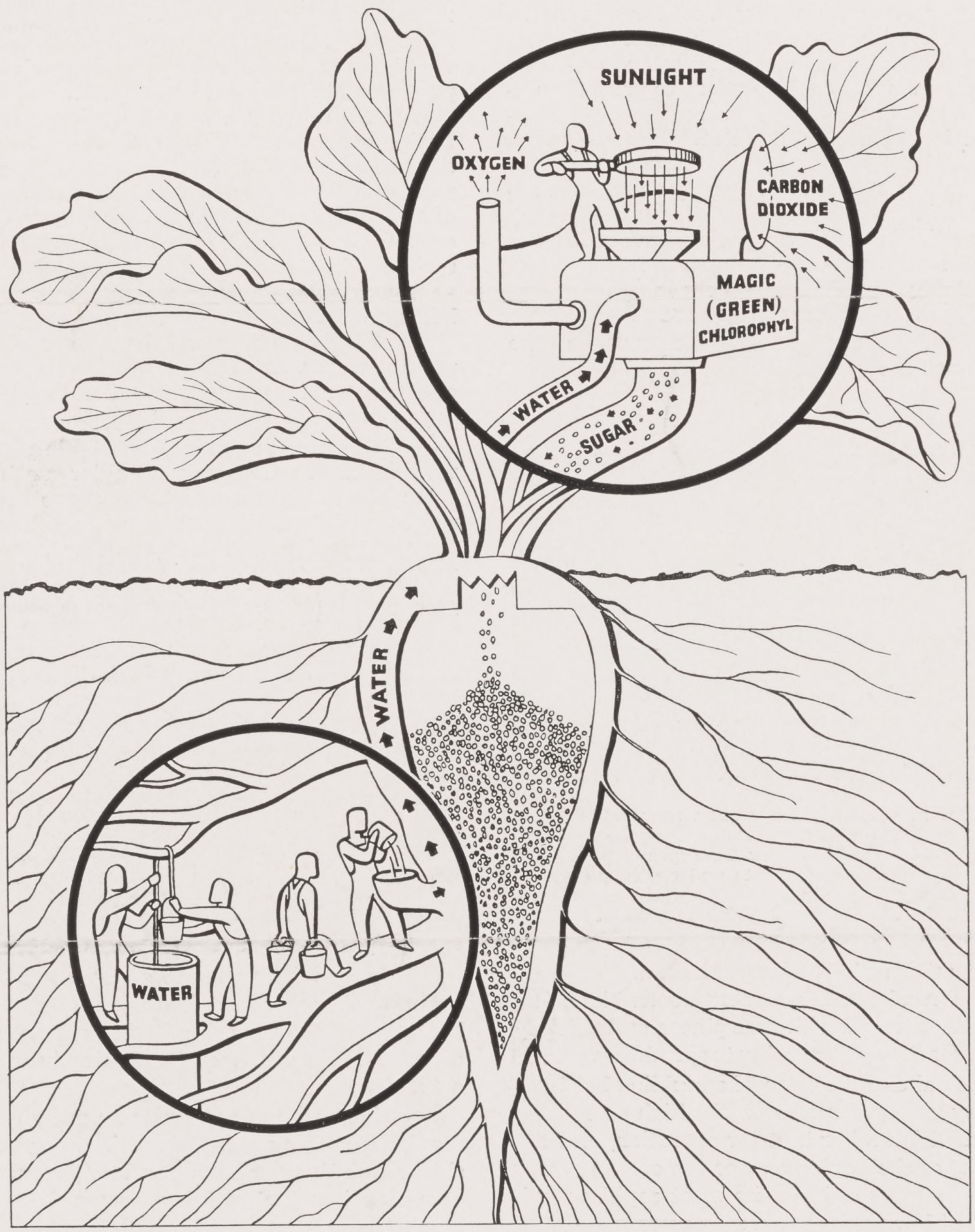
The one principal disadvantage of sprinkling has been its cost. Contrary to popular opinion, the high cost is due principally to the high labor cost for operation, and not to the initial cost of the equipment, or the cost of power for pumping. Sprinkling enjoyed its most rapid growth during a period of low wages when men were paid $2.00 to $2.50 for a 12-hour shift. Even under these conditions, about two-thirds of the cash operating cost was for labor; the other third for fuel and oil for the engine. At present wages, combined with the difficulty in securing competent men for this purpose, sprinkling is less attractive. In this connection, one must remember the relative increase in wages affects all methods of irrigation to a more or less extent.

In 1936 a field study of portable sprinkler systems was made for the purpose of determining actual output of water. More than 40 systems were included in the study; fairly complete data were obtained on 37. The cost data were averaged according to the type of system. For 13 systems using tractors burning stove oil, and operating two lines, one on each side of the tractor, the average cost per acre inch of water applied was 56 cents for labor, and 22 cents for power—a total of 78 cents per acre inch, or $9.36 per acre foot. These costs did not include interest or depreciation on the investment. The average daily wage paid was $3.37 for a 12-hour shift, and the average discharge of the systems was 630 gallons per minute. For six similar systems, using Diesel tractors and having an average capacity of 850 gallons per minute, the average costs were 46 cents for labor and 12 cents for power—a total of 58 cents per acre inch. The average daily wage for these systems was $3.56. Twelve systems using only a single sprinkler line from the pump, and with an average capacity of 447 gallons per minute, averaged 70 cents for labor, and 25 cents for power. The average daily wage was $2.85. These costs would be appreciably increased at present wages. Attention to proper layout and efficiency of the system is especially important at this time.

In an attempt to reduce the cost of sprinkling by eliminating the need for moving portable pipe, a number of very ingenious traveling sprinkler machines were constructed a few years ago. These have been more or less successful depending upon certain mechanical details and the construction, and upon whether or not the machines were made to travel at the proper speed in order to apply the right amount of water. Most of these machines used a Diesel tractor, geared to travel at a speed of 1 to 2 feet per minute while operating at normal engine speed. Mounted on the tractor is a pump which discharges through two large part-circle sprinklers that oscillate back and forth through an angle of about 90 degrees and cover a strip of ground back of the machine about 250 feet wide. The water is pumped from a ditch through a suction hose that is dragged along the ditch while the machine moves continuously forward. Since pressures of 60 to 80 pounds are required to obtain good performance with these sprinklers and to cover a strip of adequate width, the capacity of these machines is limited by the power available. Most of the systems built have capacities of 400 to 500 gallons per minute. Although they are operated by one man, the ratio of output of water to man-hours of labor required is not much higher than for the customary type of system. In addition, they require ditches spaced about 250 feet apart throughout the field, resulting in some loss of crop area.

For those who are planning to use a sprinkler system for the first time a word of caution may be in order. Consider carefully your layout and the labor requirement for operation. Remember, it is the annual operation cost that is most important, not the initial cost of the equipment; therefore use good equipment and see that it is kept in good condition. Make sure the pressure at the last sprinkler on the line is adequate for proper distribution of water. Don't expect good results simply because you sprinkle—the crop needs an adequate supply of moisture at all times and it doesn't particularly matter how it gets it. Many systems have been failures simply because they did not have enough capacity for the area served and couldn't supply an adequate amount of water.

FORMATION OF SUGAR SUCROSE) IN THE BEET



Sugar is formed in the green portions of plants by a process known as photosynthesis and is destroyed in the plants by the process of respiration. Photosynthesis is the manufacture of carbohydrates (sugar), formed through the agency of the chlorophyl (green pigment) combining carbon dioxide, obtained from the air, and the water in the plant in the presence of light. In the combination of water and carbon dioxide to form sugar, oxygen is given off as a waste product.

The sugar formed by photosynthesis results in increased weight of the plant, unless respiration takes place at a more rapid rate than the sugar is formed.

Respiration is an energy-releasing process which occurs constantly in every living cell of plants or animals by taking up oxygen and releasing, as waste, carbon dioxide and water. Sugar is broken down by the process of respiration, resulting in a loss of weight by the plant.

The sugar beet is one of the very few plants in which practically all of the carbohydrates stored are in the form of sucrose (sugar).

Spreckels SUGAR BEET Bulletin

PUBLISHED FOR CALIFORNIA SUGAR BEET GROWERS BY THE SPRECKELS SUGAR COMPANY

VOL. VI JUNE 1942 No. 6

DELIVER BEETS EARLY

By G. P. WRIGHT, *District Manager*
Sacramento District, Spreckels Sugar Company

There are many important reasons for early harvest. This is particularly true for this coming harvest. Sugar has been classed as an essential food product. Acreages have been increased at the request of our Government. Labor is not plentiful. These are only a few of the reasons for an early and evenly regulated harvest.

In the March 1942 issue of the Spreckels Sugar Beet Bulletin, an announcement was made which stated that 75 cents per ton above the regular schedule of beet payments would be made to growers delivering beets during the first 20-day period of harvest. This bonus is being paid to enable growers to start their harvest at an earlier than normal date.

Well regulated distribution of labor will be unusually important during the coming harvest. Labor must be used full days and full weeks. As large a percentage of the beets as possible should be harvested previous to the period when quotas become necessary, usually in September and October.

The feeding of beet tops to cattle or sheep is more important this harvest than ever before. This is one source of income which many growers have partly or entirely lost during the past few years because of late harvest, which left no time for the proper use of this very valuable feed.

The importance of sugar production in 1943 will probably be as great or greater than in 1942. Therefore, plans should be made for fall plowing and preparation of as large an acreage as possible prior to the rainy season.

Also, from the standpoint of economy of operation and upkeep of equipment during harvest, each grower should start harvesting early so that it can be completed in advance of the heavy rains and resulting wet fields. After the rainy season starts, expense of harvest materially increases. Tractor equipment breaks down, trucks are continually working under difficult conditions which results in loss of time, delay, and expensive repairs. Repair equipment may be limited this coming harvest.

The proper care and treatment of land cannot be overlooked if maximum yields are to be secured. Late harvest is liable to result in some land being worked too wet, thus seriously damaging it for future crop production.

The company has purchased a large amount of new piling equipment. The equipment already in use and the new equipment recently purchased is being provided in order to complete harvest at a reasonable time. This piling equipment is necessary because of the large crop, even though a considerably earlier start than normal is anticipated. It should not be assumed, however, because of the piling equipment that harvest can be delayed to a date which would be convenient for each individual.

Early harvest is not a choice. It is an absolute necessity. Sugar has been designated by the United States Government as an essential food crop. It is the grower's responsibility to harvest every acre and ton of sugar beets possible. It is the responsibility of the processor to see that every ton is processed.

ELECTRICAL SOIL-MOISTURE TESTING

By F. J. HILLS, *Agricultural Department*
Spreckels Sugar Company

Ear phones and a Wheatstone Bridge may look out of place in a sugar beet field, but with the aid of such equipment it is hoped that sugar beet growers can be furnished with needed information concerning the moisture conditions of their soil.

As we mentioned in the April issue of this bulletin, this new method of determining soil moisture has been under the consideration of various research workers for several years. The Agricultural Department of the Spreckels Sugar Company has for the past two years worked on this method in conjunction with the University of California at Davis. With the thought that a valuable service can be rendered growers, a considerable number of these units are to be installed in various fields throughout the district this spring.

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(Left) Plaster of Paris blocks being placed in the soil. (Right) Wires from plaster of Paris blocks in a beet field. These wires will be connected from time to time during the growing season with a Wheatstone bridge to determine the moisture percentage of the soil at that location.

Electrical moisture testing is based on the principle (other factors being eliminated) that soil moisture is directly correlated with its resistance to an electrical cur-

(Continued on page 39)

BOOKKEEPING BY SUGAR-BEET GROWERS

By R. L. ADAMS, *Professor of Farm Management*
University of California, Berkeley

NOTE: Professor R. L. Adams was Director of the Spreckels Sugar Company experiment station located at Spreckels, California, for several years after its first establishment, approximately 30 years ago.

Legend has it that years ago Henry Miller, of Miller and Lux fame, exclaimed, "I made me more money when I kept my books on a piece of brown wrapping paper than I do now with an army of bookkeepers!" It is true that bookkeeping (and bookkeepers) is an expense unless the results of the books and the labor involved lead to an equal or, better, more than equal increase in net earnings. Bookkeeping merely for the sake of bookkeeping can chill the most ardent. But well-kept records, properly analyzed, and the analyses put to practical use are to a wise farm manager what a compass is to a mariner, a transit to a surveyor, or scales to a merchant. Bookkeeping is thus justified only as a means to an end, but not as an end in itself.

The purpose of this article is, therefore, to indicate the usefulness of a set of farm books. Keeping track of assets, receipts, and expenditures, annual determination of earnings, and figuring cost (and earnings) of a given enterprise, followed by analyses of the recorded data can serve the individual farm operator in his quest for economic security or to increase the profitableness of his business.

As I write I have before me examples of farm records kept in early days. To me it is interesting to note that Elisha Blackman of Lebanon, Connecticut, and later Wilkes-Barre, Pennsylvania, records for 1770-1798 "two days' use of yoke of oxen 50c (and a parallel entry of 3 shillings); 500 lbs. of hay 83c (5 shillings); 1 lb. of tobacco 11c; 1 gallon of rum 67c; ¼ of a town lot (in Wilkes-Barre) $9.00; skirt for Rebecca 17c; 4 lbs. of venison 13c; 2 bear skins $4.00; an almanac 10c." And the 1865 records of prices in a Utah account book included "tobacco at $2.00 a lb.; flour at 32c a lb.; sugar at 53c; bottle of catsup $1.00; 2 boxes matches $1.00" and 1 quart of whiskey, but price lost to posterity because a rat chewed this part of the page.

But properly kept accounts, though obviously of less public interest than those just cited, do become of considerable interest and value to one whose farm and farm operations are the basis for the record-keeping.

Moreover, in these changing times, with the government entering more and more into the affairs of farmers and stockmen, every farm operator has need of every business device at his disposal. Sugar-beet growers, in particular, have had experience with governmental interest (some growers call it "interference") in the growing and marketing of this particular crop.

All of this preamble adds up to a belief that sugar-beet growers will do well to maintain records not only for whatever benefit may accrue to them individually, but to provide data and evidence when matters affecting their business call for more than opinions and offhand estimates. "How much does it cost you to raise sugar beets?" "How much of this cost is incurred in thinning beets? In pulling, topping, and loading?" "What price must you receive to break even, or better, to be able to show a reasonable profit?" "How much rent can you afford to pay for land producing 15 tons of beets? 20 tons?" As time goes on it is probable that the American sugar-beet grower will

A DEMONSTRATION OF PROGRESS

10 YEARS OF DEVELOPMENT IN CURLY TOP RESISTANT VARIETIES

Sugar beet variety tests conducted by the U. S. Department of Agriculture in 1941 at Buhl, Idaho, show successive steps in the development of sugar beet varieties resistant to Curly Top. Planted in four-row plots are six varieties which represent the various stages in Curly Top resistance from the non-resistant European variety on the left to the variety containing almost complete resistance —Improved U. S. 22—on the right.

The following record of yields on this plot indicates the degree of resistance to Curly Top of these various varieties:

Variety	Tons of Marketable Beets Per Acre
R. & G. Old Type (9315)	0.00
U. S. 1 (0137)	6.31
U. S. 33 (833)	8.40
U. S. 12 (618)	11.25
U. S. 22 (922)	14.32
Improved U. S. 22 (97)	16.61

face an increasing responsibility for well-kept and complete data. It is reasonable to believe that eventually tariff changes, adjustment of wages, prices paid to growers for beets, and similar matters will arise. Only the growers are in a position to know and to supply the necessary factual material. As I think back over many years of various contacts with California agriculture, it has been the growers who knew the facts of their particular business and have won in the many major issues affecting a state of many specialty crops — and 3,000 miles from market for many of these! There's an old saying that "There's no substitute for experience." It's time to add "and knowledge."

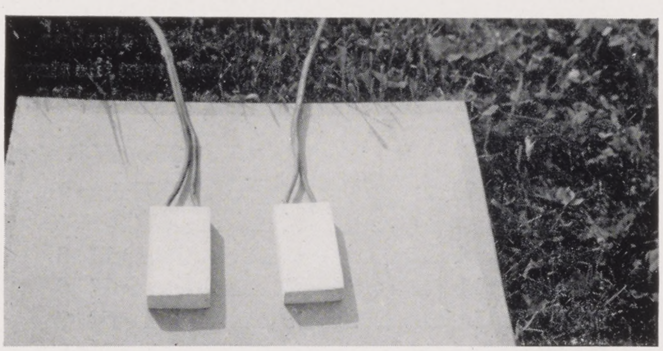
If for no other reason, the new income taxes, reaching as they do into pockets of farmers, who formerly had no need to make out tax forms, justify the keeping of records in that the burden of proof — in the event that the government auditors question your returns — rests with you. Properly planned records, with entries made while the information is fresh in mind, can prevent the headaches of trying to recall from the recesses of one's mind answers to questions propounded by a cold-eyed government auditor. You'll have a feeling that "one is deemed innocent until proven guilty" doesn't hold in taxing offices.

Granting the need for knowledge concerning the economics of sugar-beet growing, and recognizing that there are growers who have done little in the way of record-keeping, the question of "What records should one keep?" deserves consideration. The simplest way is to keep a record of cash receipts and expenditures. This is a start. If to the cash record an inventory of capital items is added at the beginning and end of the farm year, then an understanding is gained of changes in the capital structure, including depreciation of buildings, tractors, implements, and other equipment. If sugar beets are the only enterprise, then this farm basis of bookkeeping is sufficient. But usually sugar beets constitute but one enterprise of sev-

(Continued on page 41)

ELECTRICAL TESTING *(Continued from page 37)*

rent. That is, the ease with which a current can be passed through a soil increases with increasing moisture content. Wire electrodes are imbedded in 1⅜ by 2½ inch plaster of Paris blocks. Two blocks are buried at each location, one at 36 inches and another at 18 inches. Their wire leads are brought to the surface and fastened to a small stake.



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Two plaster of Paris blocks with wires imbedded in them. These blocks are buried in the soil in order that the percentage of moisture in the soil may be determined by electrical methods.

The moisture content of the block soon comes into equilibrium with that of the surrounding soil. Roots of the beets grow around the buried blocks and extract moisture from them as they do from the soil. Thus the moisture content of a block is the same as that of the soil and a reading from it is indicative of the approximate percentage of available moisture contained in the soil.

In the testing of soil moisture by actual sampling it is necessary to know the Moisture Equivalent and the Permanent Wilting Percentage of the particular soil under consideration. The electrical method eliminates this as it measures only the moisture available to the plant regardless of the soil type. After the field has been irrigated and the moisture content raised to field capacity, the resistance to the current levels off and never goes much lower regardless of how much more water is applied. As the roots extract moisture and the Wilting Point is approached the resistance increases tremendously so that further readings are meaningless. This is true for practically all soils regardless of their texture.

At regular intervals throughout the season, crew men take readings from the blocks. This is done with an instrument known as a Wheatstone Bridge, which gauges the resistance to an electric current through the electrodes in the block and gives a measurement of the amount of available moisture present. The grower is notified when the moisture content of his field is approaching the Wilting Percentage and may irrigate accordingly.

RECRUITING OF FIELD LABOR

By J. E. COKE, *General Agriculturist*
Spreckels Sugar Company

In the last issue of the Sugar Beet Bulletin, a progress report was included on the endeavor to import Mexican labor. At that time an application had been filed with the Division of Immigration and Naturalization, requesting permission to import laborers from Mexico. The Division of Immigration requested the State Director of the United States Employment Service to report on the merits of the application. The first report made by the Employment Service, we understand, indicated that although it was possible that labor supplies might be short, the Service could not actually prove that such a shortage existed. At that time there were on file with the Employment Service practically no applications for labor to work in sugar beet fields. Therefore, the official deduction of the Service was that there was no shortage. Sugar processors and some of the beet growers on learning of this situation immediately placed orders for labor, following which the Employment Service attempted to locate the labor requested. Being unable to do so, this Service again reported to their Washington Office, this time stating, we understand, that a shortage did exist and that importation of Mexicans would be necessary to meet the labor requirements in California.

In order to avoid the recurrence of the situation as outlined above, it is imperative that employers file with the U. S. Employment Service requests for all labor desired, regardless of their opinion of the ability of the Employment Service to locate such labor. Unless this is done, the true picture with regard to the labor situation in California will not be reported officially.

During the last 30 days the various departments of the Government in Washington, who are involved in the importation of Mexican labor, have been contacted frequently and information has been supplied to them in an

(Continued on next page)

LABOR *(Continued from page 39)*

attempt to secure clearance for the application for the importation of Mexicans.

During last week, the Director of the United States Employment Service, Mr. Fae Hunter, visited California to determine first-hand the labor problems. He was to have returned to Washington today (May 11) to report to the Chief of the Social Security Board on the conditions with regard to labor, as he found them. We feel confident that his report will clear the way for the relaxation of Immigration regulations in order to permit the importation of Mexicans.

The Department of Agriculture in Washington has indicated, through its efforts, a strong sympathy with our problem and appears to be doing everything possible to assist in its solution.

SUGAR BEETS ON ACID SOILS

By J. H. NELSON

21 W. Channel Street, Stockton

The pH value (reaction) of soils is referred to by many agricultural scientists as the most important single determination that is made. It is the key which opens the door to the many factors which may cause poor growth of plants. In soils of high acidity (low pH value) concentrations of soluble aluminum are sufficiently high to cause injury to certain crops. This is equally true of other toxic elements. The acids causing low pH values are themselves responsible for much of the damage to many varieties of crops. Most agricultural crops favor a soil reaction somewhere between pH 6.5 and 7.0. Certain plants such as the potato grow best in relatively acid soils while sugar beets seem to grow best in slightly alkaline soils.

Sugar beets are very sensitive to acid soil conditions. They just won't produce satisfactorily on acid land. Numerous farmers are attempting to make money producing sugar beets in the San Joaquin Delta area on soils having a pH value below 5.0. Under such conditions fertilization is relatively ineffective. The farmers spend extra money for commercial fertilizers, fuss around with new techniques in irrigation, and lie awake nights worrying about a slow growing crop of beets on land which should not have been planted in the first place. Often times in their desperate attempt to perform a miracle much damage to the crop results.

Not all of the Delta land is too acid for sugar beets. There are many ranches or parts of ranches on which sugar beets do well. Growers should plant only those areas where soil pH values are favorable for the crop. If they follow such a practice their endeavors to produce larger tonnage will be likely to succeed.

What can be done about these acid soils? They can be limed. The practice of liming soils to correct soil acidity is very wise when it is carried out intelligently. Sugar beet lime is a good liming material and is cheap. It is hoped that processors will see to it that their growers can continue to get it. It has a very definite value as a soil amendment and its use for the purpose should be encouraged in the Delta area and elsewhere when needed.

It has been the common practice to guess at the amount to apply. If the amount applied was too low the growers became discouraged and immediately eliminated it from their list of good farming practices. Responses in growth from sugar beet lime applications do not show up as quickly as is generally anticipated. When nitrogen is applied the response is usually relatively immediate and very striking. This is not true with lime. Hydrated lime will correct soil acidity at a more rapid rate than will sugar beet lime (carbonate) because of its higher solubility in water. It is best to wait until the second year after applying sugar beet lime to weigh its value in crop response.

The value of pH alone cannot be used as a measure of the amount of lime necessary to correct soil acidity. It is a measure of intensity and not total acidity. In order to determine how much lime is required to neutralize the acids in a soil it is necessary to measure the total acids present. This is commonly called a "lime requirement" test. This test can be made at any reputable soil chemistry laboratory for a nominal fee.

Having this information a grower can apply the proper amount of lime to neutralize all of the acids present in his soil. Too heavy an application of lime is oftentimes more harmful than not to apply any. When this is done the soil becomes too alkaline and plants are stunted, leaves are chlorotic, and yields are generally low. The old saying, "if a little is good more should be better," is not true in this case.

Growers should take inventory of soil conditions before they select their sugar beet land. This is far more important to a farmer than any inventory he ordinarily takes. His whole future depends upon whether or not he can produce a sufficient tonnage of sugar per acre to be on the blue side of the ledger when the season is over.

Farmers are now being asked to produce more sugar. They will have very little new machinery, less labor, and less commercial fertilizers with which to do it. In view of these circumstances, soil selection and improvement from the standpoint of acidity, may be one remaining way in which to produce more tonnage on the same acreage of land in the San Joaquin Delta and perhaps other areas.

* * *

EDITOR'S NOTE: Mr. Nelson owns and operates the Nelson Laboratories in Stockton, California. His work is devoted entirely to pathological and chemistry problems in agriculture.

The measure of acidity or alkalinity of a soil is known as its pH number. The following scale indicates the degree of acidity or alkalinity of the various pH numbers. It is important to note, however, that while pH 5 on the scale is listed as slightly acid and pH 9 as slightly alkaline, an agricultural soil testing pH 5 is considered, from the standpoint of effect on plants, as strongly acid and pH 9 as strongly alkaline.

The pH Scale

Strongly acid	pH 1 to 2
Moderately acid	pH 3 to 4
Slightly acid	pH 5
Faintly acid	pH 6
NEUTRAL	pH 7
Faintly alkaline	pH 8
Slightly alkaline	pH 9
Moderately alkaline	pH 10 to 11
Strongly alkaline	pH 12 to 13

GROWERS DISCUSS IRRIGATION

By W. C. WATERMAN *and* H. T. CARLSON
Agricultural Department, Spreckels Sugar Company

Proper irrigation is generally conceded to be one of the most important phases in the production of a crop of sugar beets. The various types of soils and subsoils, with their variations in sub-moistures, drainage conditions, and general contour, require special methods of application of irrigation water in order to meet the moisture requirements necessary to produce a successful crop.

Various systems of irrigation are used in California sugar beet culture. Four of these are discussed below:

1. Overhead irrigation with rain machines.
2. Flooding by means of check levees and dams in furrows.
3. Contour irrigation.
4. Furrow irrigation.

There are other systems peculiar to specific districts, such as sub-irrigation in the peat soils. The above groups indicate the methods used for irrigating the majority of California soils utilized in sugar beet production.

To illustrate the importance to each grower of adopting the type of irrigation best suited to his local conditions in order to secure a maximum crop, reports of the experience of different growers using these various systems are given below:

G. A. GREENE — MERRITT ISLAND

"I am producing 18 to 20 tons per acre with the use of a rain machine on land that is, for the most part, too uneven to consider leveling. The rain machine also minimizes the spreading of soil diseases such as sclerotium. The overhead irrigation leaves the top soil in a much better condition than the sealing-up and heavy cracking produced with surface irrigation."

H. V. MORRIS AND SONS — DIXON, CALIFORNIA

"To compensate for the lack of level land, to attain a good distribution of water throughout the field with a minimum of hand labor, we place a field check border through the field parallel to the beet row between each twenty-fourth and twenty-fifth row, or forty feet apart. Cross check levees are run through the field by contour for each two and one-half tenths of fall which creates uniform irrigation units across the field. The water is introduced from the head ditch to the furrows between rows with siphons which provide a uniform measured flow of water. As the unit fills up, completely covering the ground from one check levee across to the other, one end of the cross check is cut, dropping the stream of water to the next unit. In field practice, the cross checks on contour are made first, and the parallel field check levees are run second to provide a solid levee the length of the run."

HARRY CARLSON — WOODLAND, CALIFORNIA

"Regarding my method of irrigation, I should like to state that, as compared with the use of wooden boxes, pipes or rubber hose sections thrust through the ditch bank, the siphon idea, which I use, is definitely superior. Some of the outstanding reasons for my being in favor of this type of irrigation are: Conservation of water and electricity, economy of operation (saving in the cost of labor — approximately 50 percent less labor is required), better penetration and water control, also a better and more uniform distribution of water."

HOWARD BEEMAN — WOODLAND, CALIFORNIA

"An important item in my irrigation program this year will be the making of proper ditches with sufficient banks to save any loss of man hours. It seems sensible to sacrifice a few beets in order to obtain a better ditch. Making a more permanent ditch to serve the whole season should prove a saving and eliminate troublesome breaks."

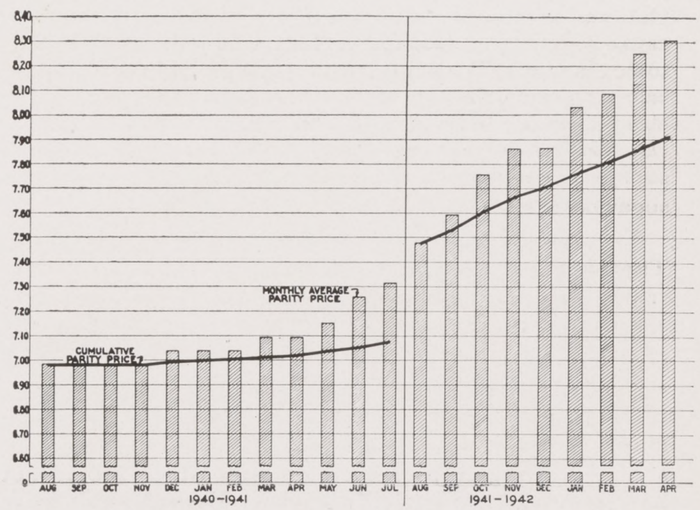
KENNETH MORRIS — WOODLAND, CALIFORNIA

"From our experiences we have concluded that the .3% contour system is especially successful on land with varying slopes of irregular directions. We find that land of a holding capacity of 10% to 17.5% of moisture with a slope of 10 in. to 100 ft. or greater produces far better under the contour system. Land of lesser sloper and higher holding capacities has produced better under the strip checking system for us. It should also be said that the strip check is by far the better type so far as harvesting is concerned; the contour being harder on equipment, particularly the trucks. Summing up our observation for farming application, I would say that deep light sandy loam with a steep slope is adaptable to the contour. For our own farming we prefer the strip check under other conditions. The length of runs in the strip checks should be determined by the fall of the land, the holding capacity, and the existing water table."

APRIL PARITY PRICE OF SUGAR BEETS — $8.31

(PARITY BASE — 1909-14 = $5.50 PER TON BEETS)

DOLLARS PER TON BEETS



BOOKKEEPING *(Continued from page 39)*

eral, which together comprise the farm business. One all-inclusive cashbook (and inventory) is then not enough. It is true that these simple books are satisfactory for income tax purposes since they do show the outcome of the farm as a whole, but for data pertaining to the sugar-beet enterprise, these records are insufficient. It is then wise to keep a special account for the sugar-beet business, crediting the account with all sales of beets, of tops (or pasture), of A. A. A. payments, and charging the account with all expenses incurred in producing the crop. These expenditures involve quite a list of items, but omission of any items means that an accurate determining of earnings and of costs is not forthcoming. These expenditures should show all cash outlays (for labor, seed, fertilizer, etc.); all costs for contract work, including hauling; proper charges for use of motive power (tractor or work animals), of implements and machinery; taxes; liability insurance; cost of irrigation water; etc. "Proper charges" include such things as cost of gasoline, oil, grease, repairs and servicing

(Continued on next page)

METHOD OF PRIMING A SIPHON

By W. B. MARCUM, *Agricultural Department*
Spreckels Sugar Company

Siphon tubes are easily started in an irrigation ditch as may be noted from the following pictures:

Fig. 1

Fig. 2

Fig. 3

Fig. 4

1. The pumping action is best obtained by pushing the siphon down into the water and pulling it back up almost to the surface.

2. When pulling the siphon out of the water, hold one hand over the end of the siphon as shown in figure No. 1. When pushing the siphon into the water, allow the air and water to escape through the end of the siphon as shown in figure No. 2.

3. When good pumping action has been obtained keep the hand over the end of the siphon as it is pulled out and down into the outside furrow. See figure No. 3.

4. Figure No. 4 shows all siphons working and the resultant lowering of the water level in the ditch.

Flow can be regulated by raising the end of the siphon which is in the furrow until only a small amount of water is coming through the siphon. Also small gates can be obtained which will regulate the flow to any desired amount.

BOOKKEEPING *(Continued from page 41)*

of tractors, horse feed, shoeing, veterinary expense, repairs of implements and machines, interest on capital invested in service equipment, rent or a proper charge for land (if deemed an expense), and all managerial service or manual work contributed by the farm operator or as unpaid labor contributed by various members of his family.

And what will such data, once properly assembled, show? For one thing, the information will permit determining how much money has been taken in and how much expense (direct cost and overhead) has been paid out. It will indicate to what extent, if any, net profits have resulted from the growing of sugar beets. It will provide data helpful to leaders of grower groups when facing problems incident to tariff changes, A. A. A. programs, changes in sugar company contracts, setting of wage rates to be paid contract labor, and similar matters.

In this brief article I have not attempted any discussion of forms — cashbook, inventory — for enterprise accounting (which involves cost accounting). There are publications available, written in simple language, and readily understandable. Then, the fieldmen of the sugar companies are frequently capable of giving advice. So, too, are the farm advisors located in each of the important sugar-beet growing counties. And secretaries of Production Credit Associations, should a grower be using short-time credit from this source. Getting on to *how* to do the job is simple, once a grower feels that he has a job which needs doing. Personally, I believe there is need for expanding the keeping of farm books by sugar-beet growers. Hence this article. If it proves to be of some good, charge it to the fact that its author was for five years in the employ of the industry and "once a sugar-beet man, always a sugar-beet man."

Spreckels SUGAR BEET Bulletin

PUBLISHED FOR CALIFORNIA SUGAR BEET GROWERS BY THE SPRECKELS SUGAR COMPANY

Vol. VI | JULY 1942 | No. 7

TIRES FOR BEET TRUCKS

By C. L. PIODA, *Resident Manager*
Spreckels Sugar Company, Spreckels

A study of the truck tire situation, as affecting beet hauling this fall, has been recently completed by the Agricultural Department of the Spreckels Sugar Company. It indicates that a number of growers will need tires for the campaign.

Under rationing regulations, trucks belonging to growers and used by them for delivering farm produce, such as beets to a processor, or beans, peas, etc., to a storage warehouse, qualify for new tires when necessary. However, there is a risk under the existing rubber shortage, that they may not be available when needed.

Local Rationing Boards are acting under strict instructions as to whom and how tires may be allotted, so it is very important that growers contact the Boards having jurisdiction, and make applications for tires required to replace any now on the vehicle that are so badly worn as to be unfit to use in the work of hauling beets, and also for the one extra tire for each vehicle which the regulations permit. Early attention to this important matter will save delays and trouble when hauling commences.

Growers will have to be particularly careful this year not to overload their trucks and to see that tires are properly inflated. Amendment No. 7 to Revised Tire Regulations provide that "On and after June 1st, 1942, a Board *may not* issue a certificate for a tire to an applicant who seeks to replace a tire carcass, which cannot be retreaded, unless the applicant can establish to the satisfaction of the Board that the carcass which he seeks to replace became unusable from circumstances not resulting from the applicant's abuse or neglect."

When making application for a new tire, the tire which is to be replaced must be inspected by an authorized inspector, appointed by the Local Rationing Board in whose jurisdiction the vehicle is garaged. If the old tire shows evidence of abuse or neglect, the inspector must so report to the Board, and it may deny the application.

It is important that truck owners make themselves familiar with the tire rationing regulations and the limitation and restrictions they will have to face in order to comply with the regulations.

NEW BEET FIELD HIGHWAY SIGNS

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Many growers are again cooperating with the Spreckels Sugar Company in advertising beet sugar by permitting the placement of the 1942 signs in their beet fields.

The signs are four feet wide and six feet high, with the background of the upper panel in yellow, and the lower panel in red.

The signs which have been in the fields in the past few years have attracted the attention of many people traveling through the country and have been of assistance, we believe, in calling to the attention of the public the importance of the beet sugar industry in California.

COMPANY ENGINEERS AVAILABLE AS CONSULTANTS

By J. E. COKE, *General Agriculturist*
Spreckels Sugar Company

If you are considering the levelling of land or the development of an irrigation layout for fields on which sugar beets will be grown, you may desire to discuss your problems with one of the Civil Engineers employed by the Spreckels Sugar Company. If so, they would be most willing to be of assistance to you.

Deciding on the method and extent that land should be levelled can become very complex. One's desire to level land so as to realize the lowest annual irrigation labor and water costs must be weighed against the cost of levelling and the quality of the soil that may be left after the cuts have been made. It is also important to know what grade is most desirable for a particular soil type and head of water that is to be used. Length of irrigation runs and size of contours or border checks are also important for consideration if an economical irrigation layout is to be obtained. Frequently, also, the amount of cash available may largely be a determining factor in the extent of the development.

While the Company's Civil Engineers may have no ready solution to this last problem, they may be able to suggest methods which will enable the grower to put to the most effective use the funds that are available. At least, they are willing to try.

The Spreckels Sugar Company so keenly desires every grower to reach top yields at minimum cost that it wishes

(Continued on page 44)

ENGINEERS AVAILABLE (Continued from page 43)

to add this additional service, hoping it may be of some assistance to growers in reaching this goal.

It has repeatedly been stated that proper irrigation is essential to securing maximum yields. Proper irrigation is certainly not possible unless the land has been levelled in accordance with the requirements of the irrigation system in use. Land levelling, therefore, becomes a fundamental requisite for maximum production. If you believe this advisory service can aid you, will you tell your Field Superintendent and he will, through the District Manager, arrange for you to consult the engineer in our organization who can be of most assistance to you.

LAND GRADING FOR IRRIGATION

By H. E. ROWE, *Civil Engineer*
Spreckels Sugar Company

Generally speaking, lands to be used for row crops which require inter-tillage are not sufficiently uniform in slope to permit best results from irrigation. We long ago passed the day when irrigation pioneers, to avoid the expense of engineering services, turned the water loose on raw land, then staked out the puddles which were to be filled by scraping off the dry spots.

Correct irrigation is more than just wetting the ground. It calls for intelligent planning and the modern farmer, being an intelligent individual, realizes that too much water can be as detrimental to plant growth as too little; hence, engineering advice and supervision are justifiable parts of such planning.

TOPOGRAPHIC MAP IS FIRST STEP

The first step in planning an irrigation development is to have prepared a topographic map of the area under consideration. On such a map, topography is indicated by contour lines which show the direction and amount of slope. and also any irregularities (a contour line represents the location of all points of equal elevation in the field). The general slope and irregularity of the land will govern the contour interval; that is, fairly level land may suggest contour lines for every .2 or .5 of a foot; rough or steep slopes may call for contours every foot, or two feet in extreme cases.

DISTRIBUTION SYSTEM AND PLANTING DIRECTION

With such a map completed, the engineer is ready for the second step — to lay out the distribution system and the direction of planting, which, by the way, is not always down the valley nor away from the hills. If the source of water is not at the highest point of the land, as it is to be graded, pipe lines will be required. Concrete pipe, the life of which is practically unlimited, is becoming increasingly popular for distribution systems, the initial cost being offset by the elimination of ditches where no crop can be produced, where weeds and rodents flourish, and where much water is wasted through seepage and evaporation. If ditches are to be used, they must be located on a uniform grade so the water will move freely but not fast enough to cause erosion. Similarly, the direction of planting should be so established that the flow of water in the furrows will not cause erosion (water should remain practically clear throughout the length of runs). Permissible grades will vary with the character of the soil.

ACTUAL GRADING IS FINAL STEP

The third and final step is the actual grading operation, the object being to so prepare the land that water can be *uniformly* distributed. May we here emphasize the proven fact that every dollar spent in accomplishing that result will be repaid many times over through increased yield and more economical use of water. If water must accumulate in a low spot to force it over a high spot, excessive and wasteful seepage occurs. The soil in the low spot gets more water than it needs and becomes "puddled" instead of maintaining the "crumbly" structure so essential to best plant growth, while the high spot gets insufficient water to maintain good growing conditions. Plants "breathe" through their leaves in order to grow, and if the water accumulated in the low spot deposits a thin film of mud on the leaves as it recedes, plant growth is retarded until this mud cracks and is shaken off by the movement of the leaves in the wind.

Unless the land is very irregular, grading operations are usually conducted back and forth in the direction of planting. The engineer sets stakes, indicating the amount of cut or fill, these items being balanced so no waste effort occurs in moving dirt. Extreme irregularities will likewise be balanced, even though the movement of dirt may be at variance from the direction of planting. Modern earth-moving equipment, either the dozer or carry-all type, tractor drawn, is used for all primary grading. When cuts and fills, as indicated by the engineer's original stakes have been completed, the finishing touches are made with a land plane, a scraper with an extremely long wheel base and wide tread so that the passing of any wheel over a

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Land partially cleared. Note height of sand dune ahead of the tractor and pick-up.

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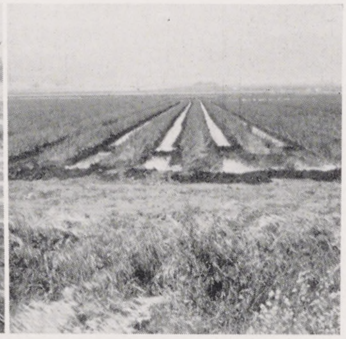
Same land upon completion of grading.

small irregularity in the land surface has little effect on the blade. Small humps and depressions are effectively smoothed out, and on land thus prepared, uniform distribution of water without waste is possible, resulting in economical irrigation, uniform moisture and soil conditions and maximum yield.

THE WRONG WAY. Notice how the water has been built up in the furrows in the right foreground, in an attempt to force it over the higher ground to the left.



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THE RIGHT WAY. Notice the even distribution of water over well graded land.

First costs on this class of work sometimes appear excessive but careful study reveals the economy of such measures. Recently, certain small areas which were so irregular and so completely covered with brush that they were considered poor pasture lands were completely cleared and graded at a cost of $88.00 per acre, using rented equipment. This land which formerly returned no revenue whatever, now rents for $25.00 per acre, so the economy of this grading development is evident. Birds inhabiting the brush were driven away, resulting in further economy through the elimination of partial crop loss on the areas immediately adjacent to the brush. Water was already available so the only expense involved was for grading, which, in this case, was far above the average.

Land which is quite irregular can be put in shape for $10.00 to $15.00 per acre. If desired, the cost of developing a parcel of land may be spread over several years, either by completely finishing a portion of the area, or by partially grading the entire area each year. To go over a field with a land plane will cost the farmer $1.00 to $1.25 per acre, using his own tractor and plane. With rented equipment, it may cost him as much as $2.00 per acre. Conditions vary so greatly that only by a careful study of each individual case can the engineer estimate the cost of such development. As a general conclusion, it is safe to say that if the soil is of such character that it will produce paying crops, the cost of any grading improvement is fully justified.

Similarly, it may appear that grading equipment is costly. Let us assume that a grower is to plant 300 acres of beets. Naturally, he has a tractor. A land plane will cost him about $1600.00. If its use increases the yield of beets by one ton per acre, and that is not unreasonable to expect, the cost of the equipment and the expense of the first planing is returned. The grower still has an implement which will last him many years and make further returns for each time it is used. Also, it can be rented to neighbors at a profit. Carry-all equipment is costly too, but if you have enough rough work to do, it will yield dividends. If you have only a small amount of land to prepare for irrigation, rent the equipment for the job, but by all means, get your land in shape to return its maximum yield. It pays!

FIELD SAMPLING TO AID EARLY HARVEST

By HUGH F. MELVIN, *Agricultural Superintendent*
Spreckels Sugar Company

Because of the large tonnage of beets to be processed in the Spreckels Sugar Company's three factories this year, an early harvest is more important than ever before. In order to help determine the earliest possible starting date, the Company has planned an intensive field sampling program. This is for the purpose of ascertaining the number of fields with beets having a sugar content high enough to be harvested. After the factories have commenced operations, deliveries must be sufficient to maintain capacity production.

Tentative plans for sampling are as follows:

All beets planted prior to January 15 will be sampled June 15.

On June 29, samples will be taken from all fields planted through February 15.

On July 13, all fields that were planted prior to March 15 will be sampled.

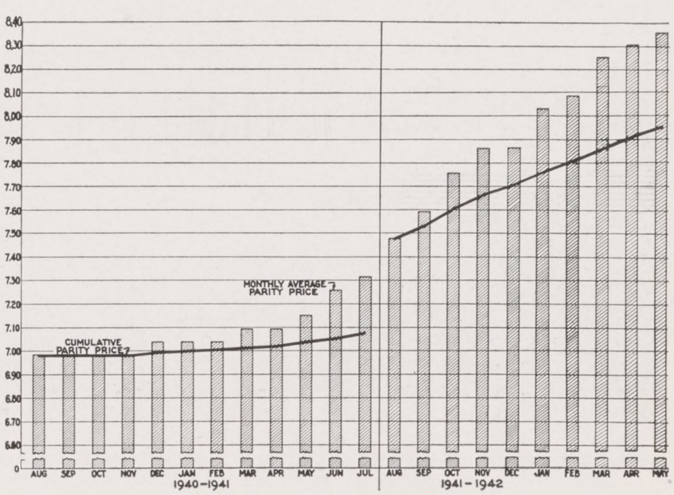
A number of samples will be taken from each field in order to determine an average percentage. Fields showing the highest sugar content will be sampled more extensively and, based upon the results of the laboratory tests, the first beets to be harvested will be selected.

It is essential that growers work closely with the Field Superintendents on this sampling program in order that farming operations may be regulated to effect the earliest possible harvest. In order to avoid any unnecessary delays, all harvest equipment should be checked in the very near future to make certain it is in operating condition.

MAY PARITY PRICE OF SUGAR BEETS — $8.36

(PARITY BASE — 1909-14 = $5.50 PER TON BEETS)

DOLLARS PER TON BEETS



SHEARED SEED PLANTINGS REDUCE LABOR REQUIREMENTS

By W. B. MARCUM, R. B. BROWNSCOMBE,
and G. ZELLINGER, *Agricultural Department*
Spreckels Sugar Company

Extensive trial plantings of sheared seed were made this season under a variety of field conditions. With the cooperation of interested growers, over 700 acres have been planted either in strips, test plots, or commercially. The John Deere planter cans, which were used in these trials, were equipped with 72-hole plates and the seed rate was varied by making gear changes on the planter drive bar.

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Fig. 1.—Sugar beets planted with sheared seed at the rate of 6.7 pounds per acre.
Photograph—By S. W. McBirney, U. S. Dept. Agr.

The early plantings were made with a 30-tooth gear at seeding rates of 6½ to 7½ pounds per acre. This high rate of seeding produced a heavy pre-thinning stand, except where planted too deep or where a crust formed prior to emergence of seedlings. In such cases, the thinned stand was generally lighter than from whole seed planted under standard practice. However, such lighter stands were accepted commercially and have been thinned at a lower than normal cost.

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Fig. 2.—Unthinned sugar beets, planted on peat soil with sheared seed at the rate of 2.3 pounds per acre.
Photograph—By S. W. McBirney, U. S. Dept. Agr.

In later plantings, 20-tooth and 24-tooth gears were used to plant at rates of 5½ to 6½ pounds of seed per acre. Most of these plantings produced a thick stand with a high percentage of singles. Some of the later plantings were made at rates of 3½, 4, and 5½ pounds per acre on a commercial scale. All of these later plantings produced satisfactory pre-thinning stands with the proportion of singles as high as 73%.

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Fig. 3.—In the foreground are sugar beets planted with sheared seed at the rate of 6.4 pounds per acre and in back of the stick can be seen the beets planted with whole seed at 18-20 pounds per acre.
Photograph—By S. W. McBirney, U. S. Dept. Agr.

A comparison of stands obtained from these plantings with those from whole seed standard planting is shown in the following table:

PLANTING	Average Seedlings Per 100 Ft.	No. Inches Containing Seedlings Per 100 Ft.	No. of Single Seedling Per 100 Ft.	% of Inches With Singles
Sheared Seed (early)	509.0	334.8	199.5	59.6
Whole Seed (early)	981.7	456.3	129.7	25.4
Sheared Seed (early with crust)	214.3	157.3	111.5	73.1
Whole Seed (early with crust)	757.3	390.5	145.8	36.2
LATE:				
Sheared Seed:				
30-tooth gear	636.7	367.8	198.2	54.5
24-tooth gear	570.3	359.0	196.8	55.6
20-tooth gear	574.0	385.5	237.0	62.2
16-tooth gear	415.3	294.0	195.3	66.6
14-tooth gear	371.3	265.3	188.7	70.6
12-tooth gear	335.0	240.0	172.5	71.5
Whole Seed	1976.0	612.0	124.0	19.9

The above tabulation of seeding rates and resulting stands indicates the possible advantages that may accrue from the use of sheared seed, especially with the present labor situation. With proper conditions for planting and germination, growers can select the seeding rate desired, depending on whether the beets are to be thinned by hand, cross-blocked, or thinned with a long handled hoe. A good stand from sheared seed as compared with a good stand from whole seed can be thinned at a lower cost with a greater percentage of single beets. In general, the heavier seeding rates of sheared seed from 5½ to 6½ pounds per acre are best suited to hand thinning or cross blocking. Lower seeding rates of 4 to 5½ pounds give excellent stands for thinning with long handled hoes. Seeding rates of 3 to 4 pounds generally give an evenly

distributed stand that possibly may be left unthinned, the average spacing being 8 to 10 inches.

Under poor germinating conditions, the method of thinning used will depend on the stand obtained. Several commercial fields planted at a rate of 4 to 5½ pounds per acre were left unthinned, the stands obtained ranging from 100 to 120 beets per 100 feet with 72 to 78 per cent singles. Other stands obtained from lower rates of seeding were thinned in the 14 to 18 leaf stage, by means of long handled hoes at a cost of $4.25 per acre.

Planting of sheared seed varies somewhat from whole seed. In general, it requires a more carefully prepared seed bed with moisture near the surface. The seed should be treated with Ceresan. Sheared seeds are much smaller than whole seeds and they tend to drop to the bottom of the furrow made by the planter shoe or disc; therefore, checking the depth of the seed in the groove helps avoid planting too deeply. Uniform spacing of seeds in the ground is important; hence, planter slippage should be minimized. The drive chain should not be loose, the cans should be tight on the frame and the tractor should be driven at a constant speed of two to two and a half miles per hour.

PROGRESS REPORT ON FIELD LABOR

By J. E. COKE, *General Agriculturist*
Spreckels Sugar Company

Word is expected any day from the State Department in Washington, D. C., giving the results of its negotiations with the Mexican Government with regard to the importation of Mexican laborers for work in the sugar beet fields in California.

The application of the California sugar processors and growers has been cleared through the various departments of government in Washington and for the last two weeks has been in the hands of the State Department, which is carrying on the negotiations with the Mexican Government.

The efforts of the agricultural commodity group, now in Washington representing sugar beets, vegetables, cotton and other agricultural commodities requiring large amounts of field labor, are apparently meeting with some success. The Department of Agriculture appears to be in sympathy with the request of this group that large quantities of field labor from Mexico be brought in under government direction for use in the field crops of California and Arizona. Paul V. McNutt, Director of the War Manpower Commission, is taking an active part in the negotiations and, although the negotiations have as yet made little progress, it is hoped they may do much to relieve any labor shortage in the general agricultural areas in these two states.

The beet sugar companies operating in Utah, Idaho, Montana, Wyoming, Colorado, and Nebraska have been quite successful during the last few weeks in securing a substantial quantity of Japanese field laborers from the army reception centers. Although this source of labor became available relatively late for most districts, it has done much to relieve the labor situation in these states. This is of great advantage to California as it eliminates the possibility of companies operating in these states recruiting other types of labor from California.

WOMEN IN FIELD WORK

By C. E. CRANE, *Agricultural Superintendent*
Spreckels Sugar Company

This spring as the labor shortage in the Salinas Valley became more and more acute, we saw women workers in greater numbers than ever before appearing in the crews that were doing various kinds of field work. This was true especially of the hoeing crews in both beets and lettuce, and in the guayule nursery, where over 800 girls and young women have been employed in weeding the nursery beds.

These women are good workers, doing perhaps a more careful job than the average male crew, and, where paid by the hour, as are most of the crews in the Salinas Valley, turning out as large a daily acreage as the men.

Mr. J. E. Culver of King City, with 340 acres of beets, found himself in a tough spot. He had 140 acres of beets that were unthinned, and the other 200 acres, although thinned, badly in need of hoeing. Beets at the thinning stage do not cease growing, nor do weeds wait to be taken care of, especially following rains and mild weather. He had only a small crew thinning and another hoeing in the worst of the weeds. Not nearly enough men were available to take care of both jobs. Mr. Culver and the Agricultur-

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THE 1915 BEET HARVEST

The picture above shows beets hauled with the C. L. Best "Track Layer". These beets were hauled by Mr. F. Tabata for the Spreckels Sugar Company on its Ranch No. 9 at Soledad, California.

Rope nets were used to unload these beets. One can be seen in the first wagon.

WOMEN IN FIELD WORK (Continued from page 47)

ists of the Spreckels Sugar Company scoured the country looking for labor. Every man of all the field crews throughout the district seemed to be busy either thinning or hoeing beets and lettuce, or doing orchard work.

Finally, a crew of about fifty was located on the California Orchard Company's property; forty of the crew were women workers. This crew was about to complete the job upon which it was engaged and was willing to take over Mr. Culver's hoeing job. Arrangements were made to shift to the thinning crew the men in the original hoeing crew who were capable of thinning. The hoeing work was then completed by the new crew. This took care of Mr. Culver's problem quite satisfactorily before it became too serious.

Mr. Culver should be commended for his timely and persistent efforts to help himself out of a bad situation, and the women workers for having early realized the serious situation confronting the growers, and assisting in its alleviation.

SALVAGE ALL BURLAP BAGS

As a result of the war, manufacturers are finding it difficult to supply much over 50% of the burlap bags needed by farmers to take care of this year's production of food crops and seeds.

This is forcing the producers to substitute second-hand bags in many cases, consequently great care should be taken in handling bags in which produce is stored and shipped.

In the case of beet seed bags particularly, every useable bag should be resold to the Sugar Company which furnished seed to growers. (See Spreckels Sugar Beet Bul. Vol. VI, page 1.)

The Office of Agricultural Defense Relations, in an effort to induce bag users to take better care of used bags, makes the following suggestions:

Care of FILLED bags

1. Store all commodities in a dry, protected place.
2. Handle bags with care, to avoid dropping and rupturing.
3. Use no hooks in handling bags.
4. Stack all of a kind together because the strength of the bag cloth varies with the commodity.
5. Don't stack filled bags so high that the weight ruptures the bottom bags.
6. Protect the commodity from rats to prevent damage to bag as well as to its contents.
7. Allow no chickens or animals access to bags.
8. Open bags at seam by cutting stitching instead of cloth.

Care of EMPTY bags

1. Shake thoroughly to remove as much of commodity as possible.
2. Hang all bags in the sun to dry to prevent mildew and rot.
3. Do not use kerosene or objectionable chemicals in cleaning bags.
4. Store dried bags, each kind to itself, in a high, dry place.
5. Inspect regularly to prevent rats or vermin nesting.
6. Do not fill bags to be reused later with objectionable items like coal, etc.
7. Tie the bags into bundles and sell them as containers.

Sorting Bags

1. Careful sorting pays for itself by obtaining higher prices from bag dealers.
2. Pack bags flat.
3. Avoid putting bags of different materials, different capacities, different sizes, or bags for different commodities in the same bundles.
4. Sort into bundles all bags that can be used again for the commodity originally packed.
5. Bundle all patched bags separately.
6. Keep slashed bags together.

Spreckels SUGAR BEET Bulletin

PUBLISHED FOR CALIFORNIA SUGAR BEET GROWERS BY THE SPRECKELS SUGAR COMPANY

Vol. VI AUGUST 1942 No. 8

PRINCIPLES OF FURROW IRRIGATION

By J. B. BROWN, *Extension Specialist in Irrigation*

Agricultural Extension Service, University of California

The most widespread method of application in the irrigation of sugar beets is by furrows. While sprinkling, cross-furrowed contour basins, and subbing from spud ditches are methods used in certain localities, it is probable that more than 80 per cent of all sugar beets in California are furrow-irrigated. The application of water by this method requires knowledge of soil moisture properties, how water penetrates the soil, and to what depths for given amounts, and how to secure fair uniformity of application. No other method requires more judgment on the part of irrigation management in determining when, how much and over what periods of time water is to be applied. No other method requires as much skill on the part of irrigators.

As no two situations will ever be exactly alike, no hard and fast rules can be given for furrow length and grade nor for length of time water is held in the furrows.

An appreciation of the advantages and limitations of furrow irrigation is important for all growers. Since good yields of high quality beets are necessary to offset production costs and to show a profit, beets are usually located on the better lands. Desirable soil types are very fine sandy loams, loams and silt loams. Such soils have me-

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COVER CROPS AID SOIL AERATION

By J. E. COKE, *General Agriculturist*
Spreckels Sugar Company

The average quantity of nitrogen applied to sugar beet acreage in California is less than 80 pounds per acre, or equivalent to 400 pounds of ammonium sulphate. A good cover crop will return to the soil an amount of nitrogen in excess of that contained in 600 pounds of ammonium sulphate. For example, a cover crop test conducted in 1938 by Dan Best at Woodland[1] gave the following results:

Cover Crop Variety	Green Weight Per Acre (Tons)	Nitrogen Per Acre (Pounds)	Ammonium Sulphate Necessary to Supply Nitrogen (Pounds)
Fenugreek	12.5	100	500
Purple Vetch	9.16	120	600
Austrian Winter Peas	8.67	115	575

Cover crops are valuable, not only for the nitrogen they carry, but more important because of their mechanical effect upon the soil. Soils may be rich in plant foods, but if they are so compact or puddled that air is excluded, the plant roots can absorb nutrients only slowly. The organic matter incorporated in the soil, when cover crops are plowed under and from the roots of the crops, aids in holding apart soil particles, thus permitting aeration.

[1]Spreckels Sugar Beet Bulletin. March, 1939.

To demonstrate the importance of aeration, Dr. Albert Ulrich of the Division of Plant Nutrition of the University of California grew two lots of beets, shown in the photographs below, in water culture under identical conditions, except that one of the solutions was aerated. The water cultures in each of the jars contained adequate supplies of plant nutrients to support normal plant growth and the amount of nutrients in each jar was the same. Air was bubbled continuously through one of the jars in contrast to the second jar, which received no artificial air.

The great difference in both top and root growth between the two treatments is adequate evidence of the importance of proper aeration of the medium in which beets are grown, whether soil or water. Unless the roots obtain oxygen they are not able to take up the nutrients that surround them.

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Difference in top and root growth of beets in the two photographs above is due to a difference in aeration of the medium in which the roots were grown. Both groups of beets were grown in solutions containing the same amount of nutrients. The only difference in treatment was that air was bubbled through the nutrient solution in which the beets on the right were grown, while the nutrient solution on the left was not artificially aerated.

(Photographs—Courtesy Dr. Albert Ulrich, University of California)

High water tables, as well as compact or puddled soils, are responsible for limiting production of beets in many fields, because a proper supply of oxygen is not available to the roots. If this condition exists it can be remedied only by lowering the water table or loosening the soil. It is of little or no value to attempt to stimulate growth by the application of fertilizers if these conditions exist.

Other than avoiding the working of land while it is wet, thus puddling it, the use of organic matter to create the

(Continued on page 50)

COVER CROPS AND AERATION (Continued from page 49)

desired soil structure is the most practical and efficient plan for most growers.

The improper use of cover crops can cause considerable damage. Many beet crops in the past have been reduced in yield because of their improper handling. Sufficient time must elapse between the plowing under of the cover crop and the planting of the beet crop to permit the major portion of decomposition to take place. Therefore, the program of the use of cover crops must be carefully worked out. Cover crops must be planted early, preferably in October, and plowed under at a time which will permit decomposition of the organic material prior to planting of the succeeding crop.

There is little choice between the varieties of cover crops generally used, except that under most conditions purple vetch can be expected to equal or exceed other leguminous crops in production of organic matter and nitrogen. Fenugreek and Austrian winter peas are also good. While nonleguminous crops, such as grain and mustard, if plowed under with the addition of nitrogen supplied from commercial fertilizers, are as effective as leguminous crops, they are not considered as satisfactory as most legumes because of the hazard of ungerminated seed, causing a weed problem in the crop to follow.

COVER CROPS INCREASE SUGAR BEET AND BEAN YIELDS[1]

By ALBERT ULRICH

Division of Plant Nutrition, University of California

It has been shown that cover crops have favorable effects on a great many crops in many climates and it was therefore no surprise when increases in yield were obtained with sugar beets and beans grown in pots at Berkeley. These experiments, started in 1937, were conducted in 33-gallon pots containing Metz silty clay loam obtained from a typical sugar beet field at King City. Each pot at harvest time had four well-developed sugar beets (U. S. 15), which were cleaned, weighed and then analyzed for their sugar content at the Woodland Factory of the Spreckels Sugar Company. The bean yields from 12 plants for 1940 and the beet yields, sugar percentages and the sugar produced by the 1941 beet crop are given in the following table:

Influence of Cover Crop (*Melilotus Indica*) on Bean and Beet Yields

Two-Year Crop Rotation: First Year	Two-Year Crop Rotation: Second Year	1940* Bean Yields Grams	1941* Beet Yields Grams	1941* Sugar** Grams
Beets	Beets	....	163	26
Beets	Beans	29	164	27
Beets	Winter cover-crop followed by beans	44	360	53
Beets + nitrogen	Beets + nitrogen	....	999	160
Beets + nitrogen	Beans	33	1,281	209
Beets + nitrogen	Winter cover crop followed by beans	48	1,496	246

*Each figure represents an average of six determinations.

**Since the sugar percentages were not affected by the crop rotations, these values are omitted. The average for all treatments is 15.9 per cent.

[1]Assistance was furnished by the personnel of the Works Project Administration Official Project No. 65-1-08-91-B-10.

The influence of the cover crop on the growth of dwarf cranberry beans may be seen from the photograph taken of the first crop of beans grown in the pots in 1938 and by the bean yields for 1940 given in the table. In 1940 the cover crop resulted in a 52 per cent increase in bean yield for beans following beets which had received no nitrogen. The corresponding increase in bean yield caused by the cover crop for beans following beets which had received nitrogen was 45 per cent.

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Above. Bean plants following beets without an intervening cover crop.

Below. Comparable bean plants with an intervening cover crop of *Melilotus indica*.

The beet yields for 1941 given in the table illustrate two major effects, one caused by the addition of nitrogen to the beets and the other produced by the crop rotation. The largest increases in yield were caused by the addition of 27.8 grams of ammonium sulfate to each pot at thinning time, while lesser but still important increases were brought about by the crop rotation. Beans rotated with beets had no effect upon the beet yields when the beets were not fertilized with nitrogen. When beets received nitrogen and rotated with beans, then the beet yields increased from 999 grams to 1,281 grams, or 28 per cent.

The melilotus cover crop grown during the winter and turned under one to two months prior to planting the beans had a greater influence on the beet yields than when beans alone were in the rotation. The introduction of the cover crop with the beans in the cropping system increased the beet yields from an average of 164 grams to 360 grams, or 120 per cent. Beets receiving nitrogen and rotated with beans increased from 1,281 grams to 1,496 grams, or 17 per cent, when the cover crop was introduced in the rotation. When the 1,496-gram yield is compared to the aver-

age beet yield of 999 grams from the pots without a crop rotation but fertilized with nitrogen, then an increase of 50 per cent is shown in favor of comparable beets rotated with beans and a cover crop.

The increases in beet and bean yields produced by the cover crop in these experiments are so large that responses in the field are very likely to take place. Whenever possible, field trials should be conducted in order to determine the value of legume cover crops in your locality.

EXPERIMENTS TO BENEFIT GROWERS

By W. B. MARCUM, R. B. BROWNSCOMBE, *and* G. ZELLINGER

Agricultural Department, Spreckels Sugar Company

The 1942 experimental program was planned with the view to developing methods of increasing sugar production with less labor and decreased cost. During the War Emergency, it is the purpose of the Spreckels Sugar Company to investigate and test ways and means by which this may be accomplished. Promising methods tried under commercial conditions and found successful will be recommended to growers.

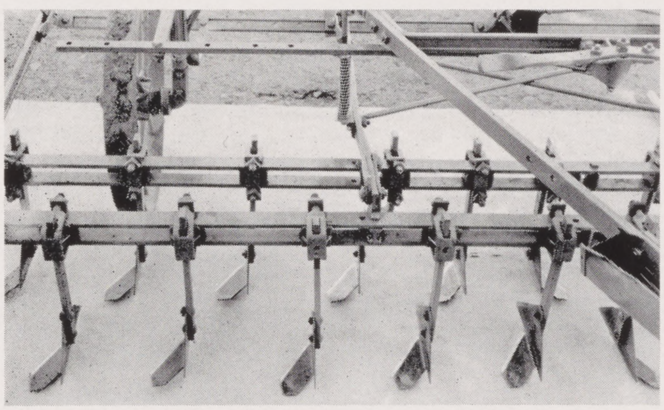

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Fig. 1. Weeder knives mounted on a cultivator for cross-cultivation are set to cut six inches and leave a two-inch block.

(Photograph by S. W. McBirney, U.S.D.A.)

The various projects include mechanical harvesting, mechanical blocking, sheared seed planting, planting of hormone-treated seed, irrigation control, and production studies.

The following is a summary of the progress being made:

MECHANICAL HARVESTING

Two of the largest agricultural machinery manufacturing companies of the United States are building several beet-harvesting machines of the type developed at the University of California at Davis. These machines will be placed in the field for testing this year.

Four machines, built according to University specifications, have been purchased by the Spreckels Sugar Company and will be used in this season's harvest.

MECHANICAL BLOCKING

A number of trials with cross-cultivators and Dixie Cotton Choppers (see Figs. 1 and 2) were made in commercial fields with the following results: (1) A satisfactory job was done if the stand was not too thick (see Fig. 3). (2) Leaving a two-inch block in heavy stands results in a high percentage of beets per block (see Fig. 4). (3) Any decrease in yield as a result of cross-blocking will be

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Fig. 2. A Dixie Cotton Chopper adjusted to leave one-inch blocks on four-inch centers.

(Photograph by S. W. McBirney, U.S.D.A.)

balanced in the cost of thinning provided that more than 50 per cent of the blocks contain singles or doubles. (4) Cross-blocking saves a considerable amount in the hoeing costs.

Indications are that an acceptable job of cross-blocking can be done in fields with thin stands resulting from low seeding rates, and that many fields planted at higher seeding rates with heavier stands can be cross-blocked if smaller blocks are left. This may be attained by closer knife spacing and the use of shields or discs if there is a tendency to push out the blocks.

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Fig. 3. Cross-blocking saves labor and decreases hoeing costs.

SHEARED SEED PLANTING TRIALS

(See Sugar Beet Bul. Vol. 6, p. 45)

Good results were obtained from numerous sheared seed plantings. The conditions under which these tests were made varied sufficiently to check the reliability of this type of seed.

Plans are now being made to build a multiple shearing mill at the Woodland Factory that will greatly reduce the cost of shearing.

Most of the trial plantings were made with plate planters. Several tests made with fluted feed drills indicate that

(Continued on page 52)

ORGANIZATION CHANGES

Because of the added burdens and increasing complications of our agricultural operations as the result of the War effort, the Spreckels Sugar Company announces the following changes within its organization:

After twenty-three years of outstanding achievement in the Sacramento Valley, where he has been District Manager, Mr. George P. Wright has been transferred to the Salinas Valley as District Manager, with headquarters at Spreckels. Mr. Wright will be ably assisted in his new duties by Mr. W. H. Paulsen, Agricultural Superintendent of the Salinas District.

The Dean of the Agricultural Department of the Spreckels Sugar Company, Mr. Chas. L. Pioda, Resident Manager, with a meritorious record of over forty-six years, will turn over the active administration of the agricultural operations to the younger Mr. Wright. Mr. Pioda will act in an advisory capacity to the larger organization.

Mr. Hugh F. Melvin, who has been Mr. Wright's assistant in the Sacramento District, has been appointed District Manager of that district, while Mr. Ward C. Waterman, formerly Assistant Agricultural Superintendent, has been elevated to the position of Agricultural Superintendent in the Sacramento District.

EXPERIMENTS FOR GROWERS *(Continued from page 51)*

through the use of such drills there is a possibility of reducing seeding rates to 3½ to 6½ lbs. per acre, with fair distribution.

GROWTH-PROMOTING SUBSTANCES

Recently, publicity has been given to the use of various chemical substances to increase growth and production. These are termed "growth-promoting substances," or hormones.

Numerous competent investigators have been using such chemicals to stimulate reproductive and vegetative activities of plants of various kinds. These tests have given startling results and justify further experiments on a wide range of crops.

Two experimental plots are planned this year in which sugar beet seed will be dusted with Naphthalene Acetic Acid as a growth stimulant and results will be carefully checked.

IRRIGATION CONTROL PROGRAM

Increased knowledge is being gained regarding the best irrigation practices for the profitable production of sugar beets. This is based on known data regarding the soil moisture content at different depths and under varying growing conditions.

Approximately 800 plaster of Paris blocks (see Sugar Beet Bul. Vol. 6, p. 37) have been installed in the various districts to be used in determining soil moisture by the electrical testing process throughout the irrigation season. This will enable growers to obtain the results of such tests promptly and regulate their irrigation accordingly, thereby increasing yields and reducing costs. Growers wishing this service should contact their Field Superintendent.

PRODUCTION STUDIES

Fifty fields in the Woodland area are being studied intensively, with the aim to correlate yield differences with various practices carried out in these fields. Records are being kept of these practices and in addition each field will be tested for soil porosity, soil moisture, total soil organic matter, soil pH, root growth measurements, petiole analysis (nitrate, phosphate, and potash) and harvest yields. Trends will be noted and reported.

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Fig. 4. Two-inch blocks left after cross-blocking a thick stand. Shields or discs could have been used to reduce the size of blocks to one inch, giving a higher percentage of singles.

THE IMPORTANCE OF COVER CROPS

By H. T. CARLSON *and* W. C. WATERMAN
Agricultural Department, Spreckels Sugar Company

Every farmer in the Sacramento-San Joaquin Valleys producing irrigated crops who postpones or fails to provide for replenishing the organic content (humus) will sooner or later face the problem of rebuilding or disposing of an unproductive farm.

Sugar beets, beans, tomatoes, grains, seed crops, cotton, are all soil-depleting crops in that by their cultivation a certain amount of organic material is used, eventually requiring replacement. By growing certain combinations of the above crops in rotation, the day of reckoning can be postponed to some degree, but not forever.

Plowing under heavy growths of cover crop in late spring, and the production of alfalfa are the two major sources for organic material in the Sacramento-San Joaquin Valleys. A fairly large acreage of alfalfa is contributing to the soil-building practice, although in certain areas of the San Joaquin Valley it is necessary to cover-crop old alfalfa land to provide organic matter for succeeding crops. The practice of growing cover crops, however, is woefully less than it should be, in terms of the total acreage of soil-depleting crops being grown. A certain amount of soil building is being gained from the plowing under of volunteer cover crops with heavy growths occasioned by excessive rainfall that delayed the plowing of the land for early crops.

The proper use of cover crops in a soil-building program requires careful planning. There is a selection of cover crops to be used from one locality to another. The vetches and melilotus indica perform better than fenugreek, sesbania, or Austrian winter peas in some localities, depending upon winter temperatures, rainfall, and types of soil. Many growers have tried and despaired of using a cover crop program because their landowner will consider only a one-year lease. It is practically worthless to plow under a cover crop with only five or six inches of growth. To satisfactorily conduct a cover crop program on any farm, the crops must be planned at least one year ahead. A heavy winter crop plowed under must be either summer-fallowed, or followed with a summer crop such as beans

or tomatoes that are planted late enough to permit the mass of green material plowed under to pass through the period of heating which would otherwise injure the growth of a young plant such as a sugar beet. An ideal cropping program with cover crops is to plant the cover crop following sugar beets in the fall. Allow the cover crop to reach its full growth, but plow under while it is still succulent in the spring and plant the field to a summer crop for one or two years, such as beans and tomatoes, and return to sugar beets.

A second suitable plan on many farms is to follow sugar beets with grain, summer-plow the grain stubble after the field is threshed, grow the winter cover crop on rain moisture, plant the land to a summer crop and then return to sugar beets.

The following sugar beet growers make these observations in regard to their use of cover crops:

1. **Paul Hanson, Tracy, California,** planted a melilotus cover crop following alfalfa plowed out in the fall. The field was planted to pinto beans and then to sugar beets the following year. The cover crop improved the physical condition of the land tremendously, improving both the water penetration, and its general tendency to seal up in the summer. He also used a cover crop in the sugar beet and bean rotation, with cover crop following the sugar beets. There is a definite need for cover crops on the heavy soils in this area. Melilotus has proven the best-adapted crop in this area, although fair results have been secured with fenugreek.

2. **George Clever, Tracy, California,** finds that melilotus is the best cover crop adapted in this area. It is irrigated in October and plowed under in early spring. If plowed under only a short time before planting of the next crop, the mass of rotting material is detrimental to the crop. The use of cover crops has greatly improved the physical condition of the soil, and though no careful check has been kept, the yield of beans appears better.

3. **John Robertson, Tracy, California,** tried a series of plots of various cover crops, using purple vetch, common vetch, fenugreek, melilotus, and burr clover. The melilotus was the most satisfactory in growth. He feels that cover crops work into the beet and bean rotation very well, and are an aid to the soil. However, the problem of getting the crop plowed under soon enough in the spring makes the next crop harder to manage. He feels the best rotation is beets, cover crop in the fall, with beans following the cover crop in the spring.

4. **Stanley Good, Woodland, California,** has found cropping a good paying practice. His plan of crop rotation has been to follow beets with a fenugreek cover crop planted after beet harvest, and plowed under the following spring before planting the field to tomatoes. This practice is followed for two years, then he plants the land to sugar beets for two consecutive years. He applied 200 pounds of Ammonium Sulphate per acre to the tomatoes. By cover-cropping, he considers the yield has increased 50 per cent.

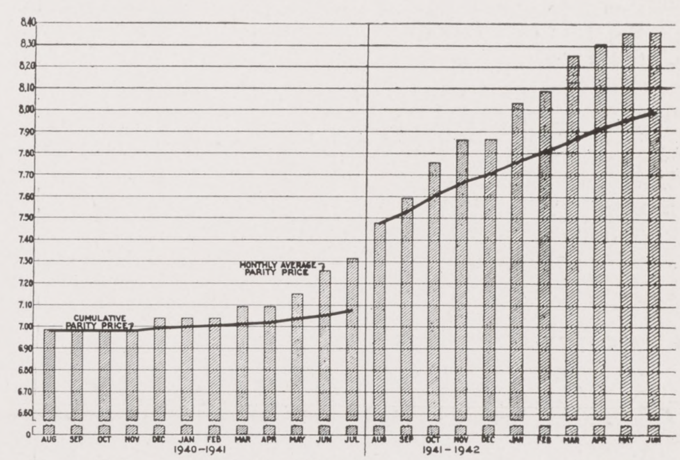
5. **W. H. Winters, Woodland, California.** Wray and Winters planted 200 acres of fenugreek cover crop last fall, which has been plowed under and the land planted to tomatoes and beans this spring. They plan to plant this land to sugar beets next year.

6. **Dan Best, Woodland, California.** In 1940 a 50-acre field was planted to 30 acres of horse beans and 20 acres to tame mustard. This crop was harvested. In 1941 again the 30 acres were planted to horse beans and the 20 to vetch. After harvesting, the field was thoroughly disced. The first fall rains started a good bean and vetch cover crop that was plowed under at the proper time and the field planted entirely to sugar beets this spring. The crop at present shows prospects of a very good yield. The 30 acres planted formerly with the horse bean cover crop shows a much more vigorous growth than the 20 acres formerly of tame mustard, and vetch.

7. **Henry Kaupke, Woodland, California,** considers cover-cropping the most practical way to build up soil fertility. In May of 1940 he planted 56 acres to cow-peas and blackeye beans. This crop was irrigated once and plowed under the latter part of September. The following year, the field was planted to sugar beets and this year to tomatoes. Both crops have made an excellent growth, which he attributes to improved soil fertility by cover-cropping.

JUNE PARITY PRICE OF SUGAR BEETS—$8.36

(PARITY BASE — 1909-14 = $5.50 PER TON BEETS)



FURROW IRRIGATION

(Continued from page 49)

dium water-holding capacities, and good to fair permeability. The recent alluvial soils in the above classifications, which show little or no profile development and are at least six feet in depth, are excellent soils for furrow irrigation of sugar beets. Natural slopes established by the deposit of these medium types of soil will be flatter than the slopes of coarse-textured sands, and steeper than the fine-textured clays.

In furrow irrigation, soil is wetted by downward and lateral percolation with some wetting of ridges between furrows by capillarity while water is still in furrows. The extent of downward and lateral percolation is determined by the length of time water is held in the furrows and by soil type. The total amount of water absorbed by the soil is measured by the rate of flow in the furrow and the time it is allowed to run. Differences in depth of penetration

(Continued on page 54)

FURROW IRRIGATION

(Continued from page 53)

between upper and lower ends of the furrow are influenced by the length of the furrow.

The essentials of good furrow irrigation may be summarized as follows:

1. **Furrows should be close enough together so that wetted areas meet.**
2. **Water should be kept in the furrows until the desired penetration is secured.**
3. **The length of the furrow should be such that the difference in penetration between upper and lower ends shall not be excessive.**

The spacing of beet rows on 20-inch centers in flat planting, and on 26-14 inches on ridge planting, is such that the soil between beet rows will always be wetted with any reasonable application of water. In sandy types of soil a reasonable spread of water to be expected is about 18 inches on either side of the furrow, while in loam types 24 inches on either side may be expected. Spread in clays may be greater, but downward percolation may be reduced on account of the lower permeability of such soils.

The length of time water is held in the furrows determines the depth of penetration. Experiments on Yolo loam soil at Davis at permanent wilting percentage (12 per cent) to a depth of six feet, showed penetrations of 18 inches with water in the furrows for eight hours, 36 inches in 24 hours, and 54 inches in 72 hours. While this vertical penetration was going on, the pattern of the wetted soil under the furrow was also spreading laterally. The total width at the top was about four feet at the time water was removed in the 48-hour run. It is well to remember that the shape of the wetted area under a furrow is like a U or a V, and is never, under conditions of free percolation, shaped like the letter A, as is sometimes supposed. It is always wider near ground surface than at lower depths. One run of one-half hour on highly permeable sandy soil of low water-holding capacity showed a penetration of 36 inches and lateral spread of 18 inches on either side of the furrow.

LENGTH OF FURROW DEPENDENT UPON SOIL TYPE

In the matter of length of furrow, it should be remembered that the flow is constantly diminishing as the water moves along its length and that more water is delivered to the land in the upper reaches of the furrow than in the lower reaches. This results in greater penetration at the upper end. The object of the skillful irrigator is to minimize this discrepancy between upper and lower ends. It is accomplished by using a length of furrow determined by soil type. Observations on permeable sandy soils showed penetrations of 12 feet at the upper end of a 600-foot run and penetration of 18 inches at the lower end, with water flowing for three hours. A run of 1½ hours and 300 feet in length showed penetrations, upper and lower, of four feet and three feet respectively.

These and other observations lead to the conclusion that on permeable sandy soils 300 feet should be the maximum length of furrow. For loams and other medium-textured soils 660 feet is a reasonable length, while on clay soils greater lengths can be used, but better control of water will be had where the length does not exceed 660 feet. The side of a square 10-acre block is 660 feet.

The grade of furrows for lands usually planted to sugar beets will vary between three inches and 12 inches per 100 feet of length. While flatter and steeper grades are used in furrow irrigation, it is difficult to regulate flows to secure even penetration on the flat slopes and to prevent erosion on the steeper slopes. Considerable faulty irrigation practice may be traced to steep grades, especially where unskilled irrigators use large heads of water and cut off the flow as soon as the stream reaches the lower end of the run. Penetration of as little as 12 inches has been observed at the lower ends of furrows handled in the above manner. Since the end sought is reasonably uniform penetration to the desired depth, and since soil type, furrow spacing, length, and grade are all fixed quantities for any given layout, it leaves only flow regulation at the furrow head to accomplish the desired results.

REGULATING WATER IN FURROWS IMPORTANT

Rates of flow in furrows may be regulated by small slide gates in surface pipe, furrow tubes through bank of supply ditch or by small siphons. Pipe gates and some furrow tubes are equipped with slides by which the rate of flow may be changed. Most furrow tubes, however, are not equipped with gates, so regulation is accomplished by raising or lowering the tube with reference to the water level on the ditch. The discharge of siphons is regulated in the same manner. A shovel cut in a ditch bank is not an efficient means of regulating flow.

The running of a large flow of water to the lower end of the furrow and then cutting down the size of the stream is effective, in some cases, in securing more uniform depth of penetration between upper and lower end of the furrow. Smoothing of the water channel by use of a suitable drag behind the furrowing tool sometimes reduces the time that it takes the water to reach the lower end of the furrow, after which the flow is adjusted to that amount which will percolate into the soil without waste. In ridge-planted beets on flat slopes, small metal tappoons with a hole to pass part of the water are used occasionally to raise water in furrows so as to reduce the time necessary to sub through the ridges.

The investigations by the Irrigation Division of the College of Agriculture and the very effective supervision of soil moisture conditions by field men of the Spreckels Sugar Company have led to greatly improved practices in the irrigation of sugar beets. It is generally accepted that beets should not be allowed to suffer at any time for lack of available water, and that between field capacity and permanent wilting percentage of any soil, water is equally available at all times.

Knowledge of the moisture-holding capacities of soil will enable the management of any particular property to determine when and how much water to apply. Practical considerations of reaching the last beet in the last row before it suffers will govern the time of starting any particular irrigation. The soil below three feet in depth will not ordinarily contain as many roots as the upper portion. Consequently the upper portion of the root zone will dry out first. Judgment as to the critical depth which is allowed to reach permanent wilting percentage is necessary so that soil moisture will be replenished in time to prevent damage to the crop, but avoid the expense of too frequent irrigation.

Spreckels SUGAR BEET Bulletin

PUBLISHED FOR CALIFORNIA SUGAR BEET GROWERS BY THE SPRECKELS SUGAR COMPANY

Vol. VI **SEPTEMBER 1942** **No. 9**

WHAT A CONTOUR MAP TELLS

By J. B. BROWN, *Extension Specialist in Irrigation*
University of California

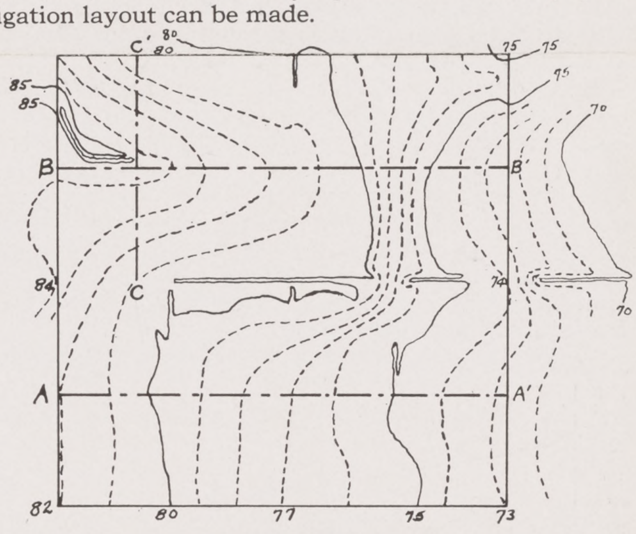
A contour map is a representation in plan of a portion of the earth's surface. On this map contour lines outline the shape of surface irregularities. All points on a given contour line are of equal elevation, and may be likened to the shore line of a pond. Usually the difference in elevation between successive contours as shown on a map is constant, and is known as the contour interval. This difference may be as little as 0.5 foot for large-scale maps used in detailed planning of grading and irrigation operations, and as much as 100, 200, or 500 feet for small-scale topographic maps of large geographical areas.

The following statements apply to all contour maps:

1. Contour lines never cross each other. (Exception—overhanging cliffs—two intersections.)
2. Contour lines make complete loops or close on themselves, either on or off the map. A map of a small area may show only a portion of the complete loop.
3. On maps of small areas where contour loops are complete, the topographic feature represented is either a summit or a depression.
4. Equally spaced contours represent uniform slopes.
5. Closely spaced contours indicate steep slopes.
6. Widely spaced contours indicate flat slopes.

The scale of a map is an expression comparing a given length on the map with the corresponding length on the ground. For detailed planning a scale of 1 inch = 100 feet or less is very useful, but such a map is usually not available and if especially made is expensive. The contour interval of such a map would probably be 0.5 foot.

With such maps as above it is possible to plan in detail all grading operations and make a complete layout of the irrigation system, but fairly sound planning can be done by using available maps of smaller scale and larger contour interval. By using existing topographic maps of valley lands in California it is possible to determine high points in rather small areas and the direction and grade of slopes. Intermediate contours may be filled in or interpolated, after which the map may be taken onto the ground and minor irregularities corrected by use of a farm level or hand level. With care and judgment a reasonably good irrigation layout can be made.



1,320 feet
"B" ENLARGED

All of the agricultural lands in the Sacramento-San Joaquin Valley and well up into the foothills above possible beet locations have been mapped by the U. S. Geological Survey. The horizontal scale is 2 inches = 1 mile, and the contour interval is 5 feet. The lands of Salinas Valley are mapped on the same scale and contour interval, as well as certain parts of Orange, Riverside, and San Bernardino counties. In Los Angeles County the coastal plain and other gently sloping lands are mapped on a scale of 1 inch = 2,000 feet, with 5-foot contour interval.

All of the sheets composing the map of these areas, except Salinas Valley, are readily available from stationery stores handling topographic maps of the U. S. Geological Survey. The price per sheet is about 15 cents. A single sheet covers about 50 square miles.

As an example of what can be done with a small-scale map, the following figures have been prepared. The section selected is near Woodland in T. 10 N., R. 1 E., M.D.B. & M., and is shown on the Yolo Quadrangle of the U. S. Geological Survey Atlas Sheets. The information on the government map is that

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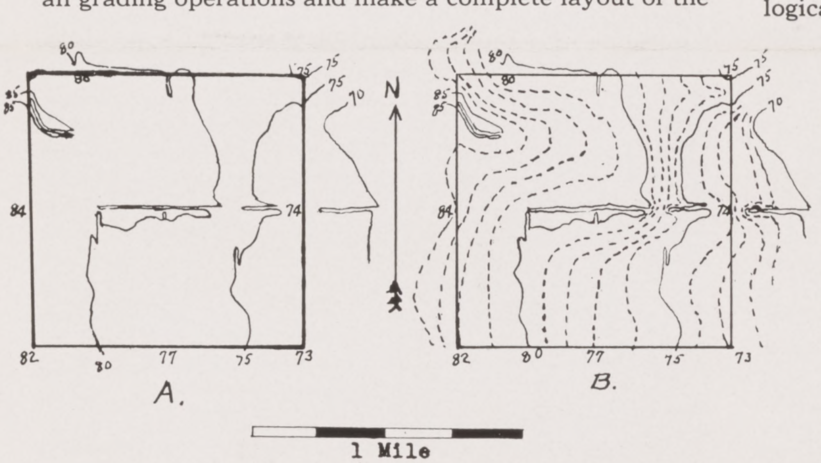


Topographic maps of a section of land in T. 10 N., R. 1 E., showing (A) information given on the Yolo Quadrangle, U. S. Geological Survey, and (B) the same section with interpolated 1-foot contours.

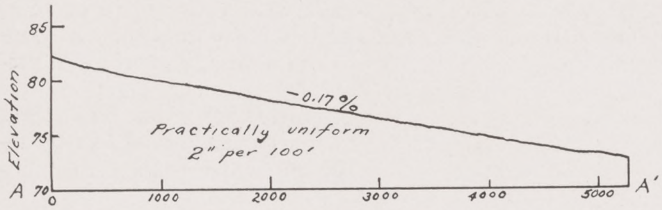
CONTOUR MAP (Continued from page 55)

shown in Figure "A." The 85-, 80-, and 75-foot contours with certain elevations at corners and other points are given. Through the middle of the section, west to east, there appears to be a drainage ditch as shown by the long re-entrant contours along that line.

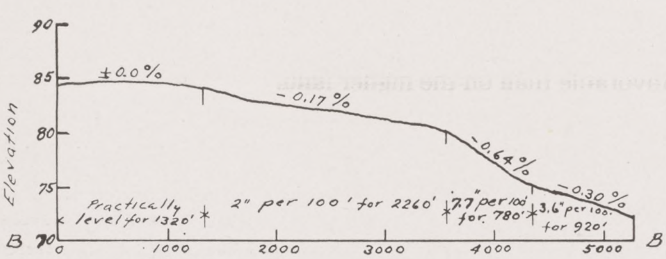
Filling in the intermediate contours as shown dotted in Figure "B," the general shape of the land is more fully developed. The south half of the section shows rather uniform, widely spaced contours, indicating gentle, even slope from west to east. About the middle of the N.W. quarter there appears to be a gently sloping ridge from west to east with the land sloping to the north and to the south from the ridge axis. In the N.E. quarter the contours are closely spaced, indicating a steep slope from west to east.

An enlargement of Figure "B" is also shown in order to indicate slopes along various lines laid down on the map. Taking the line A-A′ through the middle of the south half, the slope is shown on the profile below. At the west line of the section the elevation is 82 feet and at the east line it is about 72.6 feet. The intermediate even-foot elevations were determined by scaling distances from the west line to the point where each contour crossed the line A-A′. The line shows an even grade of −0.17 per cent, or 2 inches per 100 feet. When grade is expressed in percentage it indicates the number of feet rise or fall in 100 feet of length. Upward grades are indicated by a plus sign (+) and downward grades by a minus sign (−) before the figures showing grade percentage.

A west to east line through the middle of the north half



1.



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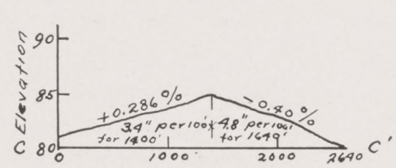


SCALES OF THE ABOVE PROFILES
Horizontal -- = 1,000 feet
Vertical -- = 10 feet

3.

1. Slope along line A-A′. West to east.
2. Slope along line B-B′. West to east.
3. Slope along line C-C′. South to north.

of the section is indicated by B-B′. Here the situation is more complicated. For the first 1,320 feet the land is practically level, then for 2,260 feet the grade is −0.17 per cent, or 2 inches per 100 feet, followed by a sharp pitch for 780 feet with a grade of −0.64 per cent, or 7.7 inches per 100 feet. The final 920 feet shows −0.30 per cent grade, or 3.6 inches per 100 feet.

The line C-C′ runs from south to north through the middle of the N.W. quarter. It indicates that water would flow north and south from the ridge extending easterly through the middle of the quarter section. On the south side of this ridge the grade is −0.286 per cent, or 3.4 inches per 100 feet, and on the north side the grade is −0.40 per cent, or 4.8 inches per 100 feet.

By laying down a line in any direction on a contour map it is possible to show the elevation of all points along that line. In the section shown, irrigation furrows would probably run west to east and north and south parallel to land lines, but in other sections the contours might indicate that more desirable irrigation grades could be had by running furrows at an angle with land lines.

THE LAND PLANE

By ERNEST HULL, *Manager, Weaver Tractor Company, Woodland, California*

Prior to the time of beet production in the Woodland area, there was practically no irrigation and, therefore, little realization of the importance of land leveling.

When beet growing was started on a large scale, wells were developed for irrigation and, during the years beets were not planted, other row crops requiring irrigation were grown. Those who were in charge of trying to produce irrigated crops on land which was not very smooth began to realize that some economical method of land-leveling must be developed.

Home-made wooden floats, 60′ long and 12′ wide, which were constructed and used by many of the ranchers, did a fair job of leveling, but the difficulty of moving them and the fact they were not very durable created a desire for some better leveling device.

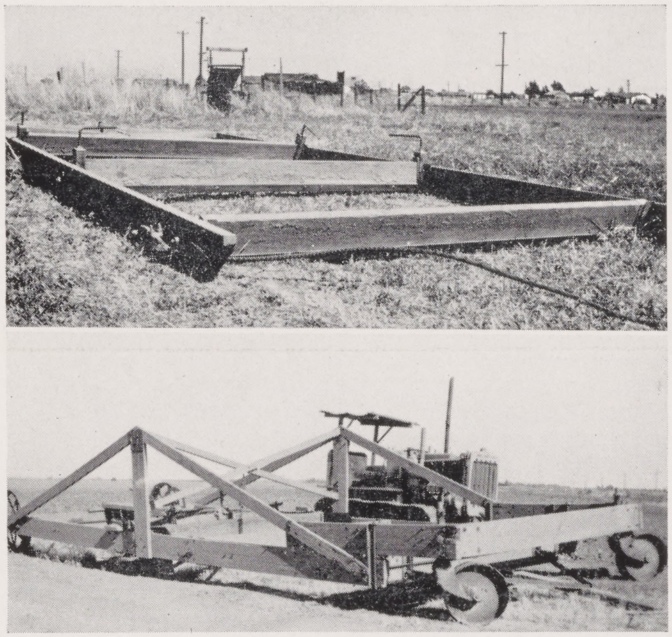
Because of this growing demand, the Marvin Landplane Company of Knights Landing, with the assistance and advice of some of the farmers, developed a land plane constructed of steel and mounted on wheels. At first one model 12′ x 60′ was constructed and later models ranging down to 8′ x 30′ were developed so that any farmer could obtain one according to the tractor power he had available.

For the last five years these land planes have been in production, over two hundred of them have been sold to satisfied customers and the demand is increasing each year.

The land plane works automatically; the blade is set at the required depth, the tractor hooked on, and the operator drives back and forth across the field, the blade of the land plane taking the soil from the high spots and depositing it in the low areas. Because of the length, it does a first-class job of planing and leveling the land.

Many farmers, who have no irrigation and are dry-farming, have come to a realization of the importance of leveling their land, because during a wet year they will have nothing on the low spots and during a dry year they have nothing on the high spots. After leveling their fields, they obtain an even stand of grain, thereby increasing their yield.

The land plane is well built, the replacement of parts being limited to the cutting edge or blade, and at present it is considered the most economical leveling equipment on the market by those who have used them for a number of years.



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The first land planing was accomplished with a long wooden float mounted on wooden runners. (Shown above.) Difficulty in moving from field to field, and lack of durability effected the next step in evolution to a plane mounted on wheels with a straight-edge wooden centerpiece edged with iron to move the dirt. (The latter is shown in the lower picture.)

The popular sizes with the farmers range from the 30′ land plane with an 8′ bucket to the 60′ machine with the 12′ bucket, although there is an 80′ machine with a 16′ bucket for unusually large acreages.

The main factor in choice to the grower between a 30′, 40′, or 60′ plane is the tractor power he has available to pull the equipment. A 30′ plane will do practically every-

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A modern 30′ land plane with an 8′ bucket. The machine is mounted on four swivel wheels to provide a maximum of maneuverability.

thing a 60′ plane will do and possibly excel on extremely rough road.

(Continued on page 59)

FARMING UNEVEN LAND INVOLVES CULTURAL DIFFICULTIES

By W. C. WATERMAN, *Agricultural Superintendent Spreckels Sugar Company*

Continual production of irrigated crops on uneven land will reduce the total area of productive land in the field. It is impossible to apply water to an uneven field so that the medium and high areas will be satisfactorily irrigated without having too much water in the low places. This creates a combination of conditions that not only reduces the yield from these low areas for the current year, but will directly affect the crops to follow on better areas on higher ground.

A piece of land is considered uneven when irrigation runs follow vertical undulations of two or three inches or more, making it necessary to flood the low areas in order to force the water over the higher places, even though the water can be made to go through without excessive shoveling. These undesirable areas in a field range from the imperceptible low places to the larger pot holes that flood and are slow to drain.

On uneven land the troubles begin with the seed bed preparation. The low places take much longer than the higher areas to dry out sufficiently so they may be worked properly. As a result, they are either worked too wet or the higher ground is worked too dry. Usually, the lower areas are worked on the wet side, which induces puddling. The soil does not work down into a satisfactory seed bed, has little or no mulch or coarse clods, and if too wet, packs down, which reduces the possibility of even a fair stand of beets. If by chance stands of beets are obtained in these areas, the ground stays wet from subsequent rains or irrigation and the seedling roots show water damage.

With early-planted beets, cultivation must be started before the low areas are sufficiently dry, consequently the ground is "slabbed up" by the cultivator tools, further inducing puddling of the soil.

At irrigation time, these areas are easily discerned in the field, because the foliage of the sugar beets is less vigorous, smaller in size, and off-color, even in the slighter depressions of two or three inches through the field, because the growing conditions for the beets have been less favorable than on the higher land.

When the field is furrowed for irrigation, check borders are run through the field every twenty to sixty rows, depending upon the contour, and a stream of water is applied to the irrigation run. As the water progresses down the furrow, each low place becomes a lake, spreading across a number of furrows, thus forming a settling basin where there can be accumulated, under conditions most favorable to their growth and development, the spores of sugar beet diseases, or eggs of insects that can be water borne. Here the soil remains wet longer than where the original eggs or spores were deposited on the higher ground; its permeability is reduced, due to puddling; and the depth of penetration is less than in the surrounding areas. Beets growing under such conditions are unhealthy and are especially liable to become hosts to its diseases and to the numbers of harmful insects prevalent and concentrated in that area.

The spores of a disease, such as Southern root rot, are washed into one of these relatively small low areas, and, upon development, will be spread back mechanically over

(Continued on next page)

FARMING UNEVEN LAND *(Continued from page 57)*

the field when the land is being harrowed and floated, thus increasing the population many times more than would have been the case had those few spores been left undisturbed on the higher ground instead of washing into the low places.

On level land with good fertility, every beet in the full length of the row should be a vigorous, healthy plant presenting a maximum of resistance to attacks of insects and diseases.

It is true that many sugar beet growers have prospered over a number of years, producing satisfactory crops on uneven land. In many instances production has been increased with cover-cropping, manuring, etc., without leveling the land, but nevertheless it remains true that the potential maximum production of the field is reduced because of the decreased yields in the low places.

In the Tracy area last year, eleven growers planted sugar beets on soil types ranging from silt loam to heavy clay loam. These soils are much more difficult to handle than most areas of the Sacramento Valley. In many fields a mulch seed bed is an impossibility. In the summer the ground bakes very hard. All eleven of these growers' names were on the Honor Roll in the Beet Bulletin as having produced yields of twenty-five tons per acre or better. **Their land is leveled**—every square foot of soil in each acre is producing its share of the crop.

Dr. J. B. Brown, in his article on the Principles of Furrow Irrigation, which appeared in the August issue of the Beet Bulletin (Vol. VI, page 54) states an axiom of good furrow irrigation: *"Water should be kept in the furrows until the desired penetration is secured."* This has been accomplished on level land with the remarkable yields obtained at Tracy. All too often, the length of time of application of water to a sugar beet crop is limited by the danger of drowning out or scalding beets in the depressions where the water has formed pools or spread across a number of beet rows.

SUGAR BEET BY-PRODUCTS IMPROVED BY CALCIUM-PHOSPHORUS

By R. D. JONES, *Agricultural Department*
Spreckels Sugar Company

Wet beet pulp, both pressed and siloed, and cane and beet molasses, have long been recognized as feeds which are an excellent source of carbohydrates for fattening cattle and for increasing milk production when properly balanced with a nitrogenous roughage such as alfalfa. However, this apparently well-balanced ration has often failed to produce anticipated gains in beef or milk production.

The addition of cottonseed cake or meal as a supplemental concentrate to a wet beet pulp, molasses and alfalfa ration has produced a decided improvement in the rate, economy and efficiency of gain, even though the additional protein supplied by the cake or meal narrowed to a considerable degree the nutritive ratio as prescribed by generally accepted feeding standards.

This brought up the question that perhaps some ingredient other than protein was possibly an influencing factor, because ample protein was being supplied by the cottonseed cake and alfalfa hay. This digestive phenomenon has been the basis of a great deal of intensive nutritional investigation and numerous feeding trials have definitely indicated that the rate of gain from the standpoint of both efficiency and economy has been influenced by a mineral deficiency. Such physical evidence as seeing the cattle eating dirt and chewing on bones also indicates such deficiency.

It is a known fact that sodium, chlorine, iodine, calcium and phosphorus are the mineral elements most commonly lacking in the animal diet. In a standard wet pulp ration ample calcium is supplied by the pulp and alfalfa hay. Sodium, chlorine and iodine are sufficiently supplied by salt, therefore phosphorus was evidently the mineral element most likely to be deficient. Experimental evidence produced at the Utah, Idaho, New Mexico and Colorado Experiment Stations through painstaking feeding trials definitely established that a *lack* of this important element in a ration was the factor that prevented maximum utilization of the feeds fed.

The Animal Husbandry Department of the University of Idaho has recently issued a circular on the phosphorus needs for fattening steers. Its work showed that it required about 60 days in the feed lot before steers produced typical symptoms of a phosphorosis (lack of phosphorus). This length of time varies from 17 to 100 days. As the rate and efficiency of gain during the latter part of the feeding period is vital to the feeder, he should not wait until this condition is manifest, but should take proper steps to forestall its development. Steer calves manifesting a phosphorosis required 30 per cent more feed to make a pound of gain and gained 37 per cent slower than calves receiving ample phosphorus.

To show the feeder how to calculate phosphorus requirement, Mr. W. M. Beeson of the department mentioned above has worked out simple tables that should be of great value not only to cattle feeders but to dairymen also.

We feel that his work is so factual that the printing of the table and equations will be of interest and help to feeders and dairymen who utilize our wet pulp in their feeding operations.

TABLE 1
Phosphorus Content of Feeds
Source: Circular 83, University of Idaho

Feed	Phosphorus	Phosphorus Per Lb. of Feed) (Grams)	Feed Required Per 100 Lbs. Live Weight to Supply Ample Phosphorus
Roughages:			
Alfalfa Hay	0.21	0.95	2.00
Oat Hay	0.17	0.77	2.60
Barley Straw*	0.09	0.41	......
Oat Straw*	0.13	0.59	......
Wheat Straw*	0.07	0.32	......
Bean Straw	0.13	0.59	......
Pea Straw	0.10	0.45	......
Corn Silage	0.06	0.27	7.40
Concentrates:			
Barley	0.38	1.73	1.20
Beet Pulp, wet*	0.01	0.06	......
Corn	0.28	1.27	1.58
Oats	0.33	1.50	1.26
Wheat	0.43	1.95	1.00
Wheat Bran	1.32	6.00	0.34
Molasses*	.02	0.09	......
Cottonseed Meal	1.19	5.40	0.37
Linseed Meal	0.86	3.90	0.52
Tankage	3.42	15.53	0.13
Minerals:			
Bone meal steamed	15.0	68.10	0.03

*These feeds are so deficient in phosphorus that animals cannot eat enough to meet body requirement.

"Table 1 gives the average phosphorus content of some

(Continued on page 60)

In Memoriam

CHESTER EVELAND

1881-1942

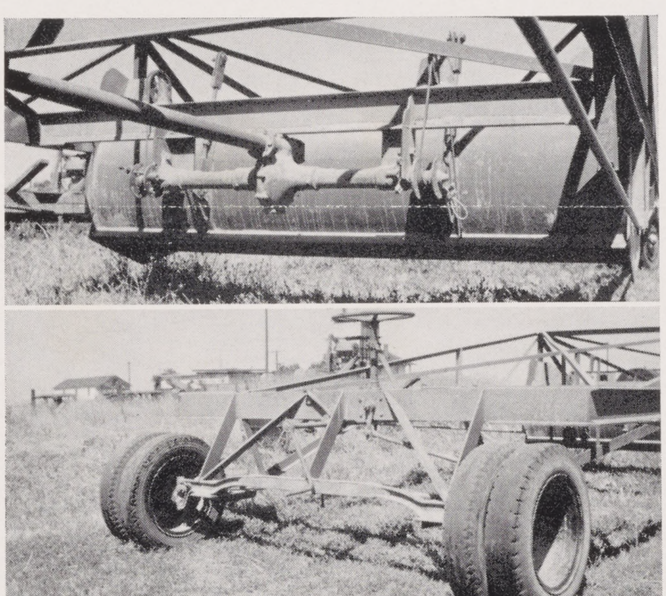
Employed since 1930 by Spreckels Sugar Company as Field Superintendent in the Agricultural Department

LAND PLANE *(Continued from page 57)*

The minimum tractor power required on draw-bar horsepower for the various-sized planes are as follows:

30′ and 40′ x 8′ bucket = 35 horsepower
60′ x 10′ bucket = 45 horsepower
60′ x 12′ bucket = 60 horsepower
80′ x 16′ bucket = 75 horsepower

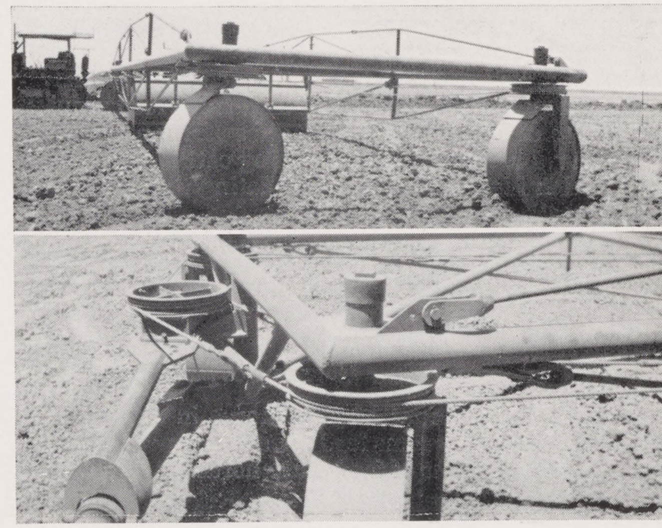
The efficiency of a land plane is in proportion to the preparation of the land. It is usually satisfactory to plow the land and plane immediately following; however, if the land is too dry or too wet, or works up in large chunks, the operation of the plane is impaired. It is occasionally necessary to plow and disc the land to obtain a satisfactory preparation for planing. A proper amount of preparation will permit a twice-over planing, once over lengthwise and a second time in a diagonal direction. Unless the blade is set severely deep for some unusual reason, land-planing is performed in second gear within the horsepower unit combinations described above.



59

A handy mechanism for raising or lowering the bucket on a land plane is shown above.

(Below.) A truck rear end is mounted with the drive shaft extending to the rear of the plane. Turning a crank on the drive shaft revolves the cable drums on the ends of the axles, raising or lowering the bucket.



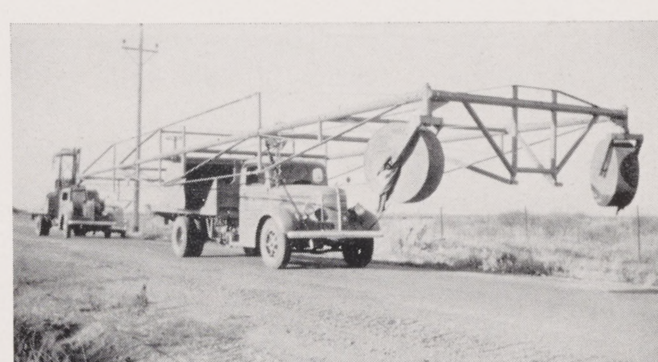
60

This 60′ land plane is constructed with all four wheels controlled with a direct cable connection to the tractor hitch. This provides a uni-directional control of the plane as determined by the direction of pull on the tractor hitch. (Above.)

This four-wheel steering arrangement is designed to prevent the plane from creeping sideways when traveling along the side of an incline in the field. It has reduced the number of operations formerly required in the field to obtain the same results. (Below.)

It is important to remember that a land plane is the last operation in a land-leveling program. The use of a scraper or carry-all is necessary to move the required amount of dirt if there are heavy fills to make, a long distance to haul the dirt, or if a decided swale is to be filled. A land plane moves a small amount of dirt for a short distance only, providing the final smoothing-out operation for a level piece of land.

A land plane should be a permanent piece of equipment on a farm of any size. The small fills will settle each year after irrigation, requiring land-planing as an operation in land preparation for a number of years. Level land has reduced irrigation costs and increased yields many times over the costs of leveling that can be accomplished with the land plane.



61

An easy, efficient, and economical system of moving a 60′ land plane is pictured above. One end of the plane is hoisted into the air high enough to back the 1½-ton truck under the bucket. The plane balances on the bucket, with each end chained down tight to the truck.

CALCIUM PHOSPHORUS *(Continued from page 58)*

typical feeds expressed in terms of percentage, grams per pound of feed and the amount of any single feed required per 100 lbs. of live weight to meet phosphorus needs. Since a single feed is not used for fattening cattle, a formula is given which may be used in calculating the daily phosphorus intake for various rations.

"To calculate phosphorus requirement:

$$\frac{\text{Wt. of steer}}{100} \times 2 \text{ grams} = \text{daily phosphorus requirement.}$$

"Example:

$$\frac{\text{800 lb. steer} \times 2 \text{ grams}}{100} = 16 \text{ grams of phosphorus daily.}$$

"To calculate amount of phosphorus in daily ration: Daily feed (lbs.) × grams feed phosphorus per lb. (Table 1, column 2) = grams of feed phosphorus.

"This should be calculated for each feed used in the ration by referring to Table 1, column 2, then add to determine total intake.

EXAMPLE 1

"As shown above, an 800-lb. steer requires 16 grams of phosphorus daily. Average daily ration—800-lb. steer:

Barley	9 lbs. × 1.73 grs. =	15.57
Alfalfa	17 lbs. × .95 grs. =	16.15
Total		31.72

"There is twice as much phosphorus in this ration as needed to meet the requirement, therefore an additional source is not needed.

EXAMPLE 2

"800-lb. steer requiring 16 grams of phosphorus daily:

Wet Pulp	60 lbs. × .05 grs. =	3.00
Molasses	4 lbs. × .02 grs. =	.08
Alfalfa Hay	10 lbs. × .95 grs. =	9.50
Total		12.58

"This ration is deficient in phosphorus (—3.42 grams). This deficit could be furnished by additional alfalfa hay but this would reduce the amount of pulp eaten. The cheapest and most efficient means for providing the necessary phosphorus is by making bone meal in one of its various forms, readily available to the animal; ½ per cent of steamed bone meal will make up this deficiency."

Some of the available sources of phosphorus and calcium also are:

	% Tri Calcium Phosphate
Decarbonized Spent Bone Char (a Spreckels product)	89.96%
Steamed Bone Meal	80.43%
Spent Bone Char	77.54%

Di Calcium and Mono Calcium phosphate carry a high percentage of phosphorus but are generally too expensive.

Besides the effect of a phosphorus deficiency in the feed lot, the beef cow herd, dairy cattle and young stock often manifest a phosphorus deficiency by an unthrifty condition, harshness of coat, dullness of eyes, swollen joints, stiffness, general leg weakness and desire to lie down. Failure to breed, abortion and decreased milk flow may also be caused by a lack of phosphorus.

PROGRESS REPORT ON FIELD LABOR

By J. E. COKE, *General Agriculturist*
Spreckels Sugar Company

After six months of continuous effort, field labor from Mexico has not yet been secured. Considerable progress has been made, however, and we believe that Mexican importation will be a reality sometime during the harvest. There is a possibility that before this Bulletin is off the press, contracts for the importation of Mexicans will have been completed and a supply of Mexican labor working in the fields. We know of a large number of Mexicans on the border at Nogales and Mexicali, who have been there hoping to be permitted to come to the United States to work. Because of the delay in clearing importation proceedings, these men are destitute. There is, therefore, in Mexico a supply of labor and in this country a need for this labor and since beet sugar processors in California have agreed to meet the numerous stipulations for importation of Mexicans, it is only a matter of cutting government red tape to secure this supply of labor. This is being pushed with all the effort and energy at our command.

In the meantime, the Spreckels Sugar Company has five men recruiting labor in southern California, Texas and New Mexico. By paying transportation and supplying food to the men, a reasonable number are being secured. For the most part, they seem to be excellent workers. Since the Company is also agreeing to supply return transportation to the men who complete the harvest, it is hoped these workers can be retained throughout the season.

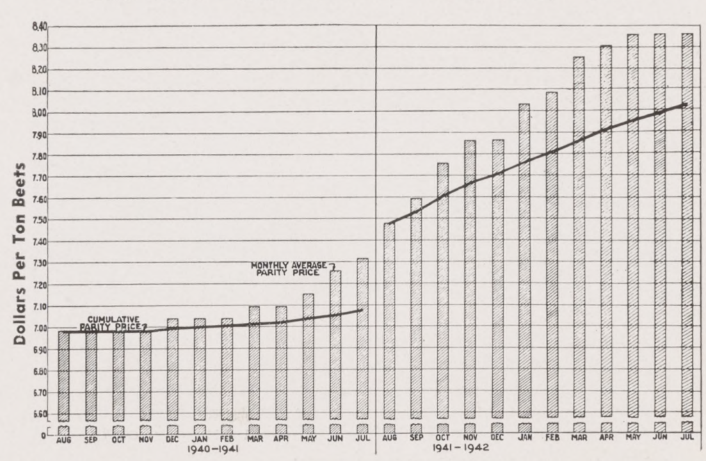
Several camps not formerly used by beet labor are being repaired by the Company for the use of this type of labor. Plans for the building of new camps are being developed at the present time and construction will start immediately if priorities can be secured.

There is a possibility that certain army units, particularly Filipino, may be provided with crop furloughs to assist harvest. The Army has already indicated that if the U. S. Department of Agriculture certifies the need for the use of the Army for this purpose, a limited number of crop furloughs will be issued. This labor supply will be available only as a last resort as the Army has a huge job of its own.

JULY PARITY PRICE OF SUGAR BEETS—$8.36

(PARITY BASE — 1909-14 = $5.50 PER TON BEETS)

CUMULATIVE AVERAGE FOR YEAR — $7.08 **CUMULATIVE AVERAGE FOR YEAR — $8.02**



Spreckels SUGAR BEET Bulletin

PUBLISHED FOR CALIFORNIA SUGAR BEET GROWERS BY THE SPRECKELS SUGAR COMPANY

Vol. VI OCTOBER 1942 No. 10

LABOR HOUSING PROGRAM

By G. P. WRIGHT, *District Manager*
Spreckels Sugar Company, Spreckels, California

BASIS FOR SHORTAGE OF LABOR

Labor shortages are experienced by sugar beet growers in times of emergency. These shortages are due to several causes. *First,* there is an opportunity for the person who has been doing field work to improve himself by going into other work that may be more desirable. *Second,* single men have been used for hand labor almost exclusively in California. Most of these single men are subject to Selective Service. Therefore the number of available men is greatly reduced. *Third,* the lack of a stable wage relationship between various field crops and industry has a tendency to make men restless and ready to move from job to job. *Fourth,* the high wages received by field workers reduces their number of work days per week. *Fifth,* improper housing facilities for either single or family labor affect the ability to keep workers.

LABOR STUDY MADE

Previous to the thinning of the 1942 crop, the Spreckels Sugar Company made a careful study of labor needs as well as housing facilities for labor. The result of this survey indicated a very definite shortage of labor and few family camps. A large percentage of field labor had gone into war industries or other agricultural work. Industry was bidding for labor against agriculture, farm crop against farm crop, and farmer against farmer.

Labor camp on ranch of Spreckels Sugar Company at King City.

ALL-OUT EFFORT TO SECURE LABOR

In an attempt to meet the labor situation, the Spreckels Sugar Company, along with other processors, filed in March of this year with the Division of Immigration and Naturalization an application for permission to import Mexican nationals for work in the sugar beet fields. After continuous effort, this attempt is now producing results.

In the meantime, additional men were employed by the Agricultural Department of the Company and were sent throughout the Southwest to recruit labor. Although over 600 workers have been brought in at the expense of the Company, this has not been sufficient to relieve to any extent the over-all labor shortage.

(Continued on next page)

MEXICAN GOVERNMENT AIDS SUGAR INDUSTRY

By J. E. COKE, *General Agriculturist*
Spreckels Sugar Company

The beet sugar industry in California has a real responsibility in handling the Mexican field workers coming to the United States from Mexico. The Mexican Government is sincerely attempting to aid its ally, the United States, in this period of great emergency. We have a common interest in the successful utilization of these men in harvesting agricultural crops in this country.

Our Government is also keenly desirous that the already friendly relations between Mexico and the United States be further strengthened. The beet sugar industry, therefore, is very much on trial in the fair and courteous handling of this group of men.

FUTURE HELP FROM MEXICO DEPENDENT UPON THE SUGAR INDUSTRY

The men have been selected with the utmost care by the Mexican Government, by representatives of our Government, and by the California Field Crops, Inc., the organization of beet sugar processors handling the labor program. Not only is it in the interests of international friendship that good relations be maintained, but it is to our own individual interest, for unless the dealing with these men is satisfactory this season, the beet sugar industry cannot expect assistance from this source in the future. It becomes the responsibility of every person who has any contact directly or indirectly with these men to assist in making this program highly successful.

HIGHLIGHTS OF LABOR AGREEMENT

The Federal Government, through the Farm Security Administration, is bringing the men into the state of California at the government's expense, except for the $5.00 per person fee, which is being paid by the California beet sugar processors.

The processors have also guaranteed employment of the workers 75 per cent of the time they are here under contract to harvest sugar beets and are subject to payment of certain stipulated amounts if work is not available for an employee 75 per cent of his contract period.

The camps in which these men are to live have been inspected and certified by the Farm Security Administration; detailed records of employment are being kept by growers; and the organization, California Field Crops, Inc., which has been set up by the beet processors, will handle other details in connection with this labor program.

SEE PAGE 64 — CONDITIONAL PAYMENTS IMPORTANT, By W. C. Waterman

LABOR HOUSING PROGRAM (Continued from page 61)

FAMILY CAMPS BEING CONSTRUCTED

The lack of housing for family labor in the beet-producing area offers serious difficulty in obtaining the best type of workers.

Because of the need for camps for families, the Company has made plans for the construction at its own expense of approximately 200 family units. Priorities are now being secured from the Government for lumber and other materials and work is now under way in construction of many of these units.

It is the plan, for the present, to group these family houses in units where the workers will be made available to growers within the area around the camp site. It is hoped, however, that in the future these units can be spread out on many growers' ranches so they will have a nucleus of reliable labor supply to take care of their needs.

Married men with their families living in the territory are, as a rule, more steady and thrifty than the majority of single workers and are not so inclined to shift from job to job.

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This family camp owned by E. E. Harden in the Salinas Valley has been fully occupied during the entire season.

LABOR CAMPS A GOOD INVESTMENT

There is no better investment for a producer of sugar beets than to have available a well-planned and constructed labor camp. During times when a large surplus of labor exists, the need for such camps is not as apparent. However, in times of labor shortage, as at present, a well-constructed and organized labor camp is a real asset.

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Salinas Vegetable Exchange camp in the Salinas Valley is a credit to any community.

There have been several excellent camps built during the past four months by individual beet growers. These camps were for single men. In future construction of labor camps it is believed that considerable thought should be given to the desirability of several family camps rather than a considerable number of camps for single men only.

BETTER HOUSING FOR LABOR

By HUGH F. MELVIN, *District Manager*
Sacramento District, Spreckels Sugar Company

It is a well-established fact that the better the housing facilities, the less labor trouble will be realized by growers. Now in the present emergency, more than ever, growers must give their attention to more adequate and modern labor accommodations. This becomes even more important due to the importation of labor from other states and the anticipation that more workers will be brought in from Old Mexico.

The Spreckels Sugar Company has made an extensive survey and finds there has long been a need for more individual, well-managed growers' camps, rather than the large community camps that have formerly been prevalent. It has been proved through experience that laborers will show their appreciation for good quarters by being more permanent and turning out a higher quality work. With th's in view, the Spreckels Sugar Company has announced a building program whereby growers may avail themselves of a pre-fabricated typical labor cabin which is 16x30 feet and suitable to be used as sleeping quarters for eight men. In addition to this, we are constructing labor camps throughout the District to aid in housing labor during this emergency.

Actual construction of these cabins had been held up pending a clearance of priorities on necessary materials. We are now in a position to put this plan into immediate operation. Any grower interested in purchasing one or more cabins should contact his Field Superintendent immediately.

The Department of Industrial Relations, Division of Immigration and Housing, advises us it is important the following information should be observed in the operation of a labor camp:

1. Camps should be located on well-drained ground.
2. An adequate supply of pure drinking water must be provided.
3. Sleeping quarters (tents or houses) should be arranged in rows with adequate spaces between.
4. Toilets should be at least 75 feet from sleeping quarters. The openings of the toilet structures must be either battened or screened and the structure made as fly-proof as possible by automatic drop-seat covers. Lime should be sprinkled in the pit every day, or pits sprayed with a commercial deodorant.
5. Toilet must not be located over streams or canals.
6. Bunkhouses, tents or other sleeping quarters must be provided. Sleeping quarters should have between four and five hundred cubic feet of air space for each occupant. Sleeping quarters (houses or tents) must be in good structural condition. Tents or houses which are in bad repair cannot be used as sleeping quarters. Whenever practicable, sleeping quarters should be screened so as to keep out mosquitoes and flies.
7. Whenever a camp is located on damp ground or when a camp operates in winter, floors must be provided in tents or houses used as sleeping quarters.
8. Bunks or beds must be furnished to all employees. The bunks or beds must be of steel, canvas, or other

(Continued on page 64)

POROSITY SAMPLING

By ROBERT T. BROWNSCOMBE, *Assistant Field Superintendent*
Spreckels Sugar Company

Porosity samples are taken to determine the non-capillary pore space of soils, that is, the air space that remains in the soil after the gravitational water is removed. Samples should be taken when the soil is not too wet, otherwise forcing the tube into the ground might compress the sample and reduce the pore space. Experimental samples have been taken this year in an attempt to correlate per cent porosity with tons of sugar per acre.

Fig. 1

Fig. 2

1. The porosity sampling tube being started into the ground by means of the removable bar handle.

2. A sledge hammer is required to drive the tube into the ground. The bar handle is removed and a steel cap is placed on top.

Fig. 3

Fig. 4

3. After the tube is driven in to the desired depth, approximately 12 inches, the earth around it is removed. The tube is then lifted carefully out of the hole and placed vertically on the ground beside the hole.

4. The outside of the tube is removed, leaving the soil column standing in the liners which are based in the head of the tube.

Fig. 5

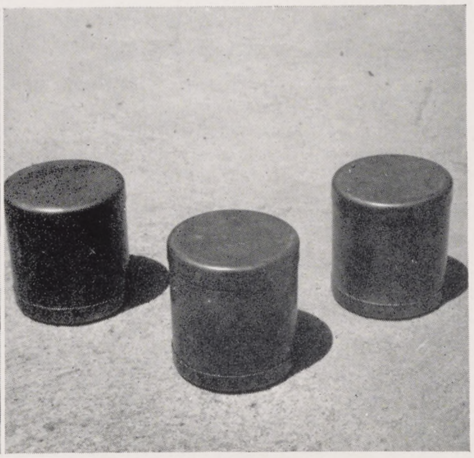


Fig. 6

5. A coping saw is used to remove the excess soil. It is also used to cut the soil between the liners, thus separating the soil column into sections.

6. Each liner contains a section of this soil, and the liners are carefully capped on both ends. In the laboratory the per cent porosity is determined.

BETTER HOUSING (Continued from page 62)

sanitary material. They must be so constructed as to afford reasonable comfort to the occupants. Where straw is used, a container or tick should be provided.

9. Tents or houses used as cooking or dining quarters must have all openings screened, and doors should have spring hinges to close automatically.
10. All drainage from kitchen sink must be run through a covered drain to a covered cesspool or septic tank, or otherwise disposed of in such a way as not to become offensive or unsanitary.
11. Garbage and refuse must be keep in fly-proof, covered containers and disposed of at intervals by incineration or by burying or by feeding to hogs. Hogs should not be allowed to roam at large in camps. They should be kept in pens at least 200 yards from living quarters (wherever location will permit). The direction of the prevailing winds should be considered when the location for hog pens is chosen.
12. There must be an adequate number of toilets, affording one seat for every fifteen persons. There must be separate toilets for men and women, marked "Men," "Women."
13. In all ranches where people work in the fields throughout the day there should be a few portable toilets.
14. Bathing facilities must be provided at all camps. The use of showers is advised, as they are more sanitary and also cheaper to construct and will accommodate more people. One shower head for every fifteen people should be provided.
15. Interior of dining and sleeping quarters, bathrooms and toilets must be kept clean and in a sanitary condition. The grounds around the camp must be kept free from filth and accumulation of rubbish, etc.
16. AT EVERY CAMP THE OWNER, SUPERINTENDENT OR OVERSEER SHALL APPOINT A RESPONSIBLE PERSON TO ASSIST IN KEEPING THE CAMP CLEAN. THIS POINT IS VERY IMPORTANT. KEEP CAMPS CLEAN.

CONDITIONAL PAYMENTS IMPORTANT

By W. C. WATERMAN, *Agricultural Department*
Spreckels Sugar Company

It is important to the sugar beet grower not to overlook the conditional payment provisions in the Sugar Act of 1937 whereby a grower is entitled to a benefit payment in the event the crop is deficient in production, or was planted and then abandoned prior to harvest due to a bone fide cause.

If the deficiency in yield or the abandonment prior to harvest is due to drought, flood, storm, freeze, disease or insects, and the farming unit is located in a district which has been designated as one within which payments will be made, a payment will be based on the normal yield of pounds of sugar per acre for the history of the farming unit, or based on the county average where there is no history for the farm.

The Sugar Act states that the total amount of sugar with respect to which payment will be computed for a farming unit will be the sum of (1) the amount of sugar commercially recoverable from the sugar beets grown on the farming unit in 1942 and marketed for the extraction of sugar, plus (2) an amount of sugar equal to one-third of the normal yield of commercially recoverable sugar per acre of sugar beets planted and subsequently abandoned due to drought, flood, storm, freeze, disease, or insects, and the farming unit is located in a district which has been designated as one within which payments will be made, plus (3) an amount of sugar equal to the amount by which 80 per cent of the normal yield of commercially recoverable sugar exceeds the actual yield of commercially recoverable sugar from such acreage, provided the cause for deficiency in production was due to drought, etc.

Inasmuch as these abandonment and deficiency payments can only be made for losses incurred as a result of drought, flood, storm, freeze, insect and diseases which cause damage to the sugar beet crop, *it is important* that this acreage be inspected by the Agricultural Conservation Office before the evidence is destroyed in order to determine the real cause for the abandonment or deficiency.

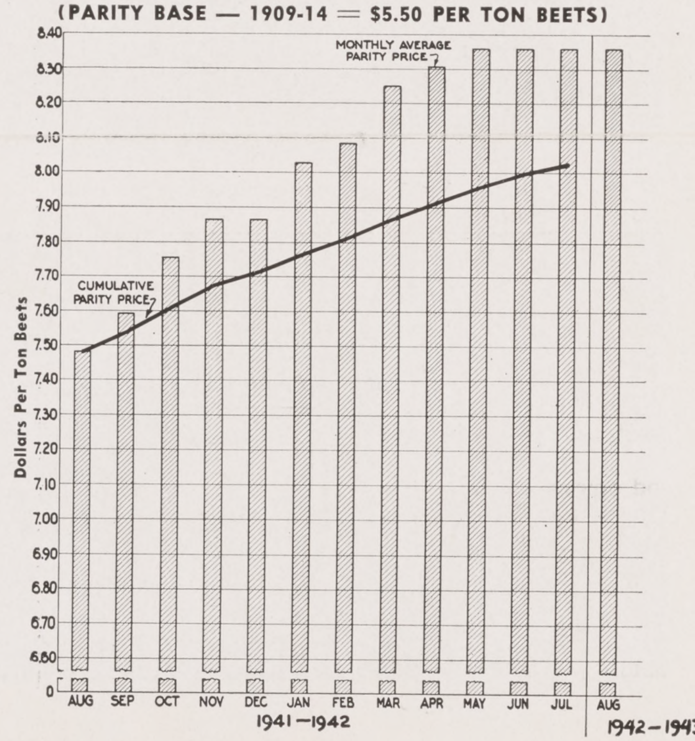
The importance of a deficiency payment is demonstrated as follows: Suppose a farming unit with a normal yield of 5,250 lbs. of sugar per acre (about 15 tons per acre of sugar beets) experiences a deficiency in production due to disease and its yield per acre for 1942 averages 2,450 lbs. of sugar per acre (about 7 tons per acre of sugar beets), the deficiency payment would be computed at 80c per hundredweight of sugar on the difference between 80 per cent of 5,250 lbs. (4,200 lbs.) and 2,450 lbs., which is 1,750 lbs. The computation then would be $\frac{1750}{100} \times 80c = \$14.00$ per acre.

If a bona fide abandonment were experienced and the normal yield is 4,900 lbs. of sugar per acre (about 14 tons per acre of sugar beets), the conditional payment would be one-third of 4,900, or 1,633 lbs., $\times$ 80c $=$ $13.06 per acre.

Be sure to notify your County Agricultural Conservation Office before plowing up an abandoned field, or before starting harvest on a deficient crop.

AUGUST PARITY PRICE OF SUGAR BEETS—$8.36

(PARITY BASE — 1909-14 = $5.50 PER TON BEETS)



Spreckels SUGAR BEET Bulletin

PUBLISHED FOR CALIFORNIA SUGAR BEET GROWERS BY THE SPRECKELS SUGAR COMPANY

Vol. VI NOVEMBER 1942 No. 11

USE OF SHEARED BEET SEED ON THE INCREASE

By ROY BAINER, *Associate Agricultural Engineer*
University of California at Davis

Approximately 10,000 acres of sugar beets produced in the United States this year were grown from sheared seed. One-half of this acreage was in California. Trials of this magnitude should be considered quite extensive in view of the fact that equipment for producing the seed was not developed until the spring of 1941.* Field experience that year was limited to the use of the seed on about one acre. Therefore, little was known regarding the best practice to follow when using the seed; such as, seed treatment, seeding rates, proper planting equipment, relative yields as compared to beets grown from regular seed, etc. Information relative to some of these items is still incomplete. Further data on yields will be available before another planting season. Additional work on planting equipment is in progress at the present time, and continued studies of seed treatment are contemplated through the cooperation of Dr. L. D. Leach of the Plant Pathology Division, University of California.

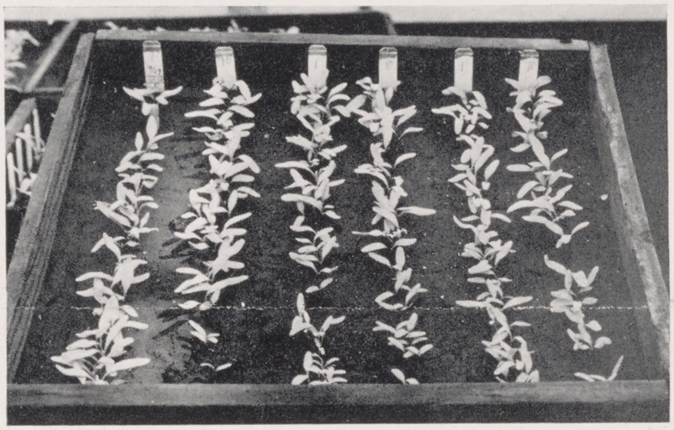
*Sheared Sugar Beet Seed Investigations. Spreckels Bulletin, Vol. VI, No. 1, Pg. 1. January, 1942.

In spite of the above mentioned limited information, a preliminary estimate indicates that approximately 300,000 acres will be planted with sheared seed in the United States during the coming year. This is primarily due to the possible savings in labor. Preliminary reports from various sections of the country indicate that the thinning can be done with a saving of at least 10 man-hours per acre. On the basis of the anticipated acreage, this saving will amount to 3 million man-hours, valued at 1⅔ million dollars at the present fixed hourly rate. In addition, the thinning can be done with long-handled hoes, thus eliminating the necessity for the highly skilled, so-called "stoop labor," which may not be available in sufficient numbers another season. In fact, some of the thinning of sheared seed plantings was done this year by women and high school boys. When satisfactory germination stands are obtained, greater savings in labor will result through the use of mechanical blocking equipment.

Seeding rates of 4 to 5 pounds per acre gave, in general, a sufficient number of seedlings to produce a satisfactory final stand. Success with seeding rates this low depends upon seed of high germination, a good firm seed bed, proper seed treatment, satisfactory moisture conditions, and the absence of climatic conditions that might produce a heavy surface crust during the pre-emergence period.

In some instances where the seed was planted in heavy sedimentary soil at the rate of 7 pounds per acre, poor stands were obtained due to crusting, while in other cases on similar soil not subjected to weather which might cause crusting, 7 pounds per acre gave far too many plants for

(Continued on page 67)



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Germination trials of sheared and whole seed at the University of California at Davis. The photograph shows whole sugar beet seed (10) vs. sheared sugar beet seed (1). In each row of sheared seed, there are 50 segments; in each row of whole seed, there are 30 seed balls.
(Photograph by S. W. McBirney, U. S. Dept. Agr.)

TREATMENT OF SHEARED BEET SEED

By L. D. LEACH
University of California at Davis

Ever since the development of the principle of separating sugar beet seed balls into smaller units, there has been a demand for information on the need, the efficiency, and the safety of seed treatment on sheared seed. Numerous tests have been conducted in cooperation with the Agricultural Engineering Division and although some information is still incomplete, certain general conclusions can be drawn.

Under California conditions typical damping-off of sugar beets may be caused by any one of three different fungi. *Pythium,* the most important organism, and *Rhizoctonia* live in the soil and attack germinating seeds or young seedlings, while *Phoma* is carried on the beet seed balls. Treatment of beet seed with Ceresan or New Improved Ceresan usually provides satisfactory protection against all three organisms. Yellow or red copper oxide provides effective protection against *Pythium* infection, but it is less effective than the organic mercury compounds against *Rhizoctonia* or *Phoma.*

Sheared seed plantings are subject to the same seedling diseases as those from whole seed, and there is some evidence that sheared seed may even be somewhat more susceptible to *Pythium* infection than whole seed. This may be due to the fact that in the shearing process the removal of the outer portions of the beet seed ball leaves the seed in an exposed position. When the rate of seeding is reduced low enough to secure the full benefit of sheared seed, even moderate infestations of damping-off organisms may, if not controlled, prevent satisfactory stands.

(Continued on page 68)

GROWERS' EXPERIENCES WITH SHEARED SEED

By W. C. WATERMAN, *Agricultural Superintendent*
Spreckels Sugar Company

Sheared seed is expected to play an important part in the production of the 1943 sugar beet crop. To be able to plant single germ seeds in the beet row, with a comfortable spacing between plants which will require only the use of long-handled hoes, will mean that the sugar beet industry will not be dependent upon large numbers of skilled stoop laborers at any one critical time for thinning and hoeing. The sugar beets will be growing mostly as singles, and will not be stunted because of lack of space.

A number of growers this year planted a portion of their fields with sheared seed for comparison with the regular or whole seed. Their combined experiences from the one year's trial have established some definite prerequisites for the use of the sheared seed. It is generally agreed that the sheared seed requires an excellent and firm seed bed; that the seed must not be planted too deep; and that it is important to treat the seed for damping-off.

The following statements are representative of the group of growers who planted sheared seed this year:

STANLEY GOOD

The following observations were made from a twelve-row strip of sheared seed planted in my field this year:

1. Planting of sheared seed requires a superior seed bed.
2. The rate of seeding should be reduced as the season becomes later. Sheared seed planting is questionable in the early season.
3. A necessary delay in thinning is not as harmful when using sheared seed as in the case of whole seed, due to the lack of competition for plant food. This lack of clumps tends to give a healthier beet, which results in better row distribution.
4. It appears that both insects and crust conditions are against the use of sheared seed planted in light rates.
5. The sheared seed strip planted this year appears to contain better beets due to the greater number of singles.

RALPH POLLOCK

We planted a small plot (about two acres) of sheared seed on March 5, 1942, in a sandy loam soil. We failed to obtain a satisfactory stand because the seed was planted too deep. Later we replanted this plot using about 4½ lbs. of seed per acre, and secured an excellent stand with a large percentage of singles. This plot was thinned by one man in little more than one day.

I believe it is essential to plant sheared seed *only* on a firm, well-prepared seed bed. Also, care should be taken not to plant seed too deep.

The principal advantages are in better and cheaper thinning, with a possible higher yield. In planting beets in the future, I would plant all sheared seed.

F. J. GREER & SONS (By F. J. Greer)

During the first week of March 1942, we planted 11 acres of sheared seed. The ground was dry on top and we had to go rather deep to moisture; the plants, therefore, were slow in getting through. About the time the plants were ready to come through, we had a rain followed by a north wind, resulting in a very heavy crust.

Conditions were very unfavorable regarding the sheared seed due to the crust, which we tried to break but with very little success. We decided that we would have to replant. Due to continuous rainfall and then snow, we were unable to do this. By the time we were able to get on the land, the weeds were about two feet high and very thick, and the beets were about six inches in height, and just a fair stand. But they had made such a struggle that we decided to leave them and see what the outcome would be, as conditions had been against them from the start.

We attached a single 6-row cultivator behind an engine and went very slowly. We cut out quite a number of beets with the cultivator as it was hard to follow the rows with either the engine or the cultivator attached behind. Still we got through with probably a 75 per cent stand. We hoed and thinned at the same operation with long-handled hoes, at a cost of $5.80 per acre, working by the hour. Otherwise, the beets had the same care as the rest of the beets in the field. The yield was 108.4 tons on the 11 acres as compared with the average tonnage of the rest of the field of about 8 tons per acre. We might say that the first cultivation was not done until the 15th of May.

We expect to plant most, if not all, our fields with sheared seed the coming year.

W. J. DUFFY, JR.

For the past three seasons I have been using, with very good results, plates in my sugar beet planter that would plant, as nearly as possible, a single seed ball. So when, in the fall of 1941, it became apparent that equipment and seed would be available to plant sheared seed, I was ready to go "all out" on this method.

Here at last was what every sugar beet grower was hoping for; a seed that would produce a single seedling. Heretofore we had thought that such a product could be obtained only after long years of work by plant breeding; but mechanized farming has stepped in and given us, overnight, so to speak, what we have long wanted.

I used sheared seed in the planting of 252 acres in the spring of 1942, and have learned something about its possibilities.

First, it is obvious that such planting will lend itself to the use of mechanical thinning to better advantage.

Second, it will improve the efficiency of hand thinning, as less finger work will be required.

Third, it bids fair to lead to the complete abandonment of hand thinning in the future as we learn more about how to use this seed. This is vitally important today when beet growers must either adopt practices where "stoop" labor is practically eliminated or stop growing beets.

In using this seed for the 1942 season I believe I have learned a few important facts. To begin with, the 1942

season in the Sacramento Valley was somewhat unsatisfactory for seed bed preparation due to a wet winter and spring, and weather conditions were far from ideal for good germination. I believe a grower should prepare a better seed bed for sheared seed than is needed for the old type seed. The seed bed should also be more firm so that a uniform depth of planting may be obtained and the soil pressed tightly around the seed.

There is a tendency to plant a little too deep with this seed, and it is apparent that it cannot stand deep planting. The seed, being smaller in diameter, tends to drop deeper into the groove opened by the planter shoe, and quite often the grower is dropping the seed a little deeper than he is aware of doing.

I believe that about five to six pounds of sheared seed per acre is about right for our clay loam type of soil. Dusting of the seed seems doubly important, as it is possible that damping-off fungus may attack the single seedling with more deadly results than when using the seed ball. A simple duster should be kept on every beet farm to dust the seed required from day to day. Use only Ceresan of recommended strength, as too strong a concentration will affect the germination.

Good stands were obtained on nearly all of my 252-acre plantings in spite of the fact that the weather was against good germination, and some of my practices were faulty. I cross-blocked approximately forty acres and got good results. In growing beets in the future I would plant all sheared seed, and would plan to cross-block the entire planting.

USE OF SHEARED SEED *(Continued from page 65)*

easy thinning. Under the more favorable germinating conditions found in the peat soils of the Sacramento-San Joaquin delta region, satisfactory stands were obtained with seeding rates as low as 2 pounds per acre. In many of the plantings made in this area very little thinning was necessary. In fact, some of the thinning was combined with the first hoeing.

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Stand of unthinned sugar beets planted with segmented seed on peat soil at the rate of 2.3 lbs. per acre. Near Stockton, California.
(Photograph by S. W. McBirney, U. S. Dept. Agr.)

Most of the sheared seed plantings have been made with the plate type planters equipped with plates designed to handle the seed. While these planters do not do the most satisfactory job of planting, their distributing characteristic is more uniform than other types of planters in their present form. It may be possible to modify other types of planting equipment to give a more uniform placement of seed when planting with low rates. Work in this direction is in progress at the present time.

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Sugar beets planted with segmented seed at the rate of 4.1 lbs. per acre. Sutter Basin, near Knights Landing, Calif.
(Photograph by S. W. McBirney, U. S. Dept. Agr.)

The use of sheared seed increased the percentage of beet-containing inches which had singles from slightly over 50 per cent for plantings of graded whole seed with the single seed ball plates, to from 70 to 80 per cent for the sheared seed for seeding rates below 5 pounds per acre. With this high percentage of singles and a fairly good distribution of seedlings, the chances of securing a satisfactory thinned stand with a high percentage of single beets is materially increased. Table I shows a comparison between sheared and whole seed plantings made at rates to give the same number of seeds per foot. In other words, 9 pounds of graded (9/64 to 13/64) seed contained approximately the same number of seed balls as there were segments in 5 pounds of sheared seed. The field (Table I) was thinned with a long-handled hoe only (no finger work), with the result that the final stand showed well over 100 beets per hundred feet of row with a high percentage of singles. Both stands were too low to permit mechanical thinning.

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Sugar beets planted with segmented seed at the rate of 6.7 lbs. per acre. Woodland, California.
(Photograph by S. W. McBirney, U. S. Dept. Agr.)

TABLE I

Sheared vs. Whole Seed Germination Stand Counts

Planter Equipment and Seed	Seeding Rate Lbs. Per Acre	Seedlings Per 100″ of Row	Beet-Containing Inches Per 100″ of Row	Per Cent of Beet-Containing Inches Which Had Single Seedlings
55-cell, single seed plate and sheared seed	5	23.0	18.8	82.0
54-cell, single seed plate and small sized (9/64″ to 13/64″) screened whole seed	9	48.5	30.7	52.5

Another series of plantings was made and irrigated up in sedimentary soil (Table II) with a plate planter having

(Continued on next page)

USE OF SHEARED SEED (Continued from page 67)

72 cells. Four rates of seeding were made with the result that satisfactory final stands of slightly over 100 beets per hundred feet were obtained in each case. The heaviest seeding rate was the only one that gave a stand of sufficient number to permit mechanical blocking.

TABLE II

Stand Counts of Sheared Seed Plantings Made at Four Different Seeding Rates

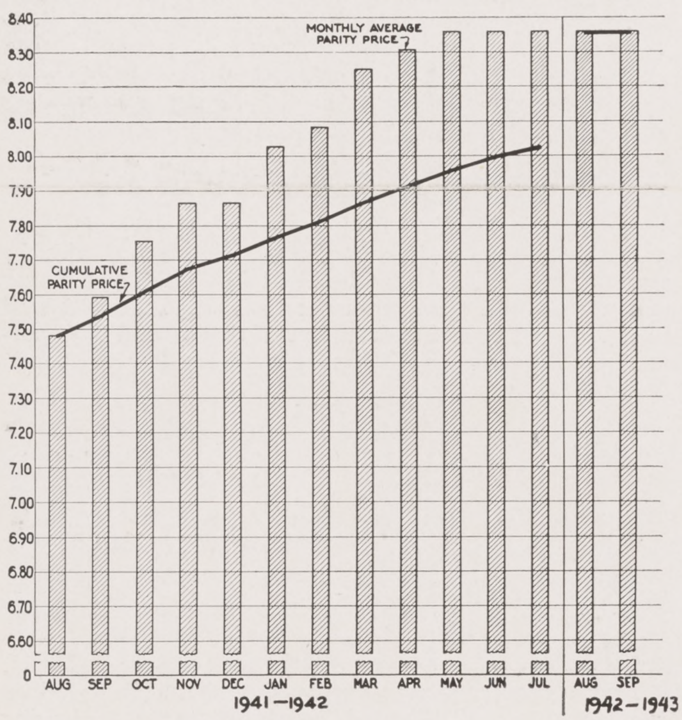
Run No.	Seeding Rate, Lbs. Per Acre	Seedlings Per 100″ of Row	Beet Inches Per 100″ of Row	Singles Per 100″ of Row	Per Cent of Inches with Singles
1	2.08	19.0	16.1	13.4	83.0
2	2.95	30.4	23.3	17.3	74.4
3	3.46	35.7	27.2	19.7	72.5
4	5.6	50.2	37.7	26.8	71.2

From limited observations it appears that the greatest gain to be made through the use of sheared seed is from light seeding rates and long-handled hoe thinning. The percentage of inches containing single beets is usually higher for the lower seeding rates, and, of course, less beets have to be removed to make a satisfactory stand. Lighter seeding rates have the advantage of prolonging the thinning period because of reduced competition; and finally, the space between the single beet seedlings makes it possible to thin without disturbing the beet that is left.

SEPTEMBER PARITY PRICE OF SUGAR BEETS—$8.36

(PARITY BASE — 1909-14 = $5.50 PER TON BEETS)

Dollars Per Ton Beets



SEED TREATMENT (Continued from page 65)

Experiments under controlled conditions have demonstrated that sheared seed can be effectively protected against *Pythium* or *Rhizoctonia* infection by treating it with either Ceresan or New Improved Ceresan. Other fungicides tested were either less effective or were effective against only one or the other of these organisms.

Sheared seed is no more apt to be injured by seed treatment than whole seed, but in laboratory tests it has been found that storing sheared seed in moist, confined conditions for 30 days after treatment with the organic mercury dusts resulted in injury expressed as delayed emergence, and in severe form as dwarfed, stunted seedlings. Such injury can be completely avoided by planting the seed within a few days after treatment, and it is suggested, therefore, that only limited quantities of sugar beet seed be treated with organic mercury compounds at one time.

The dosage of these chemicals that should be used in any locality will depend to some extent upon the severity of infestation usually encountered. Dosage trials indicate that there is little, if any, advantage in using more than 1½ pounds of Ceresan or ½ pound of New Improved Ceresan per 100 pounds of seed, while the lowest dosages that provide adequate control are 1 pound of Ceresan or ¼ pound of New Improved Ceresan per 100 pounds of sheared seed. The lower dosages minimize the possibility of injury in storage but may not provide sufficient control of damping-off under severe infestations. Investigations of this problem are being continued and more exact recommendations will be made at a later date.

Most field plantings of sheared seed in 1942 were made with seed treated with Ceresan at the rate of 1½ pounds per 100 pounds of seed. No exact data are available on the results, but, in general, damping-off appeared to be controlled to a practical degree and there were no reports of injurious effects from the treatment.

In addition to damping-off, discussed above, another type of seedling disease is frequently severe during years of late rains. During 1940, 1941, and 1942 sugar beets in certain areas of California have been attacked by the beet water mold seedling disease caused by a fungus called *Aphanomyces*. This disease seldom causes pre-emergence damping-off but may destroy or weaken a high percentage of the seedlings between emergence and thinning. Beet water mold is most abundant in slightly acid or neutral soils and is most destructive under moist conditions after the soil is fairly warm. Seed treatment does not control this disease, but early planting avoids infection by the causal fungus.

Because of the light seeding rate employed with sheared seed, even a moderate infection of water mold would leave too few healthy seedlings for a satisfactory stand. It appears undesirable, therefore, to plant sheared seed on land believed to be infested by water mold after about March 1, when the soil is usually warm enough to favor the organism.

Spreckels SUGAR BEET Bulletin

PUBLISHED FOR CALIFORNIA SUGAR BEET GROWERS BY THE SPRECKELS SUGAR COMPANY

Vol. VI DECEMBER 1942 No. 12

THE DIXIE BEET THINNER

By C. E. CRANE, *Agricultural Superintendent*
Spreckels Sugar Company

Due to the obviously impending labor shortage, the Spreckels Sugar Company during the spring and summer of 1942 intensified its study of, and experimentation with, various types of cross-cultivating and row mechanical blocking machines. Of the machines in the field to date the Dixie Beet Thinner has shown the most promise. From the results of work with earlier models of the machine, specifications were recommended to the Dixie Company for the building of a new model to fit California conditions. Because of the results shown in actual field operation of these machines and because the Spreckels Sugar Company knew the necessity for a satisfactory mechanical thinning device, the company has ordered one hundred of the new model Dixie Beet Thinners for delivery before the start of the 1943 beet-thinning season.

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Operating Dixie Beet Thinner on ridges. This machine will cover 8 acres in 10 hours.

This model is a compact, closely coupled machine with 40-inch wheel tread, which spans one bed. The cutters are set 14 inches apart, side by side, so they operate on the two rows on a single bed. The diameter of the cutters is 13½ inches, so they do not interfere with each other when working side by side. They clear themselves of cut beets and trash as well as larger diameter cutters used on earlier models of the machine. The cutters rotate in opposite directions, throwing the cut beets and trash into the furrows.

The lifting and lowering device is arranged so that the level of the cutter shaft remains as set, regardless of the depth of cut or the height to which it is raised. The manufacturer has designed a flat knife without pitch for the machine. Pitch can be given the cutters by changing the level of the cutter shaft by the screw adjustment. When the desired pitch is obtained, it does not change when raising the cutters up and down. This feature is very de-

(Continued on page 74)

PLANS TO MEET 1943 SUGAR BEET GOAL

By J. E. COKE, *General Agriculturist*
Spreckels Sugar Company

A goal of 204,000 acres has been set by the California U.S.D.A. War Board for sugar beet planting in California in 1943. In view of all the difficulties encountered in 1942 production, this is a large task.

Listed by the War Board as crops for which production in 1943 is essential are: sugar beets, flax, canning tomatoes, seeds of vegetable and field crops, livestock and livestock products, poultry and poultry products, all feed crops (with the exception of wheat), dairy and dairy products, canning peas, dried peas, pink and small white beans, and cover crop seeds.

In a statement regarding 1943 goals, the Monterey County War Board writes as follows:

> "*Sugar Beets and Canning Tomatoes*—These are so essential that those growers having land or conditions suitable for growing of these crops are requested to maintain or increase their plantings in 1943 if possible. Growers who have not grown these crops, provided conditions are suitable, will be asked to include them in their 1943 program. From 20 to 25 per cent of land suitable seems most reasonable for the growing of sugar beets."

To assist in meeting the goal set for sugar beet acreage, the Spreckels Sugar Company has adopted the following program:

1. The field labor supply for sugar beets is, of course, the outstanding problem for 1943. The Spreckels Sugar Company will continue its efforts to secure for beet growers sufficient field labor for next year. On the basis of this year's experience with Mexican Nationals, the possibilities of securing labor from this source next year seem to be good.

It is recognized that this year's experience was not without its difficulties and problems. Spreckels Sugar Company is informed that representatives of the Mexican Government who accompanied the workers to California have recommended to their Government that in the future Mexican workers should be selected from the agricultural districts rather than from Mexico City. If this recommendation is carried out, some difficulties experienced this year will be eliminated. Instead of paying workers immediately on arrival the same hourly wages paid experienced workers, an attempt will be made to establish a period for the workers to become acclimated and to learn to do the work required of them.

2. Sheared or segmented seed.

To be as certain as practicable that sheared seed will be available to growers in quantities they desire to plant, equipment for shearing seed is being installed at the company's Spreckels and Woodland seed warehouses.

It is estimated that sheared seed will be used to plant between 50 and 75 per cent of the 1943 acreage of beets to be grown for the Spreckels Sugar Company.

(Continued on next page)

PLANS TO MEET SUGAR BEET GOAL

(Continued from page 69)

Results from the series of sheared seed plots planted in 1942 indicate that satisfactory stands can be obtained with sheared seed. It has also been demonstrated that when the seed is planted at the rate of approximately 5 pounds of sheared seed per acre, large savings in thinning costs and man power can be realized.

3. The Spreckels Sugar Company has ordered and is hopeful of obtaining delivery of 100 Dixie Beet Choppers or Blockers to aid in further reducing thinning costs by mechanical blocking. These machines block the beets by being pulled "down the row."

Since cross-cultivation cannot be practiced where bed planting is used, these machines will permit mechanical blocking of this acreage. The 100 machines which have been ordered should be more than ample to take care of plantings on beds and it is planned that they will be made available, insofar as possible, to growers who practice flat planting. The machines will be rented by the Spreckels Sugar Company to growers so as to obtain maximum utilization of this equipment throughout the entire thinning period.

4. Harvest of sugar beets offers, perhaps, the greatest problems in the entire beet production program.

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Cross-conveyor developed by Mr. Hansen of the Santa Maria Valley.

The Spreckels Sugar Company will do its best to have available, if priorities for materials can be secured, beet-harvesting machinery for the 1943 crop. Beet-harvesting machinery has not yet been developed sufficiently to permit complete mechanization of this operation. However, the Spreckels Sugar Company engineers, in consultation with the engineers of the Division of Agricultural Engineering of the University of California, have developed plans for mechanization which should reduce the labor requirements for harvest from 50 to 60 per cent.

These plans call for mechanical toppers which top the beets in the ground; attachments to beet lifters which raise the beets to the surface of the ground; and cross-conveyors for loading trucks.

Several units for topping, lifting and loading beets have been in operation in various parts of the state this year and have proven to be practical.

The entire beet sugar industry is expecting some statement to be made by the Government soon regarding price and other conditions relative to the 1943 crop. However, the Spreckels Sugar Company has attempted by adopting the above program to clear the way so that the sugar beet industry in California can meet the goal of 204,000 acres established by the U.S.D.A. War Board.

MEXICAN WORKERS SELECTION PROCEDURE

By C. L. PIODA, *Resident Manager*
Spreckels Sugar Company, Spreckels

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Mexican workers outside selection station awaiting their turn to be examined.

Editor's Note: Mr. C. L. Pioda was selected by California Field Crops, Inc., to represent it in Mexico City to assist in the selection of 3,000 Mexican workers. We have asked Mr. Pioda to prepare the following article, giving his experiences regarding the selection of labor in Mexico City.

Men somewhat more adaptable to sugar beet work might have been secured had it been possible to select these men in the agricultural districts rather than in Mexico City. However, considering the material available, those responsible for this work did an excellent job of selection.

* * *

The selection of 3,000 Mexicans in Mexico City for the sugar beet industry in California was no small job. Fifty-four representatives of the United States and Mexican Governments were required for this effort. A representative of California Field Crops, Inc., was in Mexico City during the selection procedure to work in an advisory capacity.

An office was arranged for in the business section of Mexico City and on September 21 selection actually began. Prior thereto, the Department of Labor of Mexico

had sent out cards to some 14,000 individuals in various parts of Mexico, notifying them that they would be eligible for recruiting if they complied with the requirements set up.

The selection procedure was as follows: A certain number of Mexicans, who had previously been sent cards, were notified to appear each day for examination. Each man presented his card in the anteroom of the recruiting station, and was questioned by representatives of the Mexican Department of Labor. If he presented a false card, which often happened, he was rejected at once. If the card was authentic, he had to convince the examiners that he was native born and that his parents had at least been naturalized. If the Mexican authorities were satisfied, he was next questioned by representatives of the U.S.E.S. and the U. S. Immigration Department, both of whom spoke Spanish fluently, as to his agricultural background, how long since he had left that work, and what he had been doing since; whether he had ever been in the United States and if he had, whether he had been arrested, or deported therefrom. The representative of California Field Crops, Inc., was present at these interrogations and he was empowered to reject men who did not appear suitable for the work in prospect.

It was early realized that the men available were smaller in stature than is usual among such workers, and as a consequence the standards had to be lowered to meet the existing conditions.

Rejections during and following these examinations amounted to about 17 per cent; in other words, upward of 4000 men were examined in order to get 3000 who were acceptable. The largest number were rejected because of improper cards, the balance for obvious disability, youth, weight, lack of agricultural background and general unfitness.

When it was thought that the man would prove satisfactory, he was given a card and passed on to the medical

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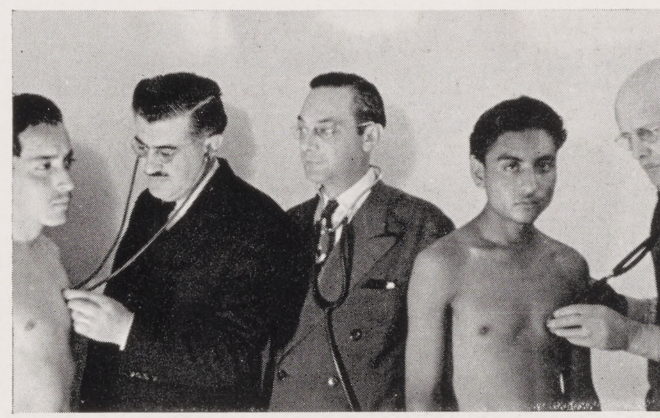
Questioning in the anteroom. From left to right: Arredondo Padilla, Inspector Federal del Trabajo; Andrew Alvares, U. S. Employment Service; Tom Gurley, U. S. Employment Service; Chas. L. Pioda, representing California Field Crops, Inc.; the Candidate.

department, where he was weighed, stripped, and examined for physical deficiencies, diseases, etc. During the last two weeks an X-ray machine was installed to test the applicants for T.B. and about 2½ per cent were rejected for this cause. The total rejections by the doctors were approximately 15 per cent.

The applicants were next photographed in groups and while waiting for the pictures to be printed, they were questioned as to their age, parentage, occupation, knowledge of farming, etc., and there was explained to them by representatives of the Mexican Labor Department and the F.S.A. that the work they would have to do would be that of topping and loading sugar beets, and the contract was explained paragraph by paragraph, also by representatives of the two governments.

Next came the actual writing of the contracts, fingerprinting, passport cards with photographs and finally in-



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Workers being examined by doctors prior to their acceptance for work in California sugar beet fields.

structions as to when and where their train would leave, and what to take with them for the trip.

The average number of men recruited per day, who were actually shipped, was 188, while the average number questioned was approximately 260. The men were shipped in five trainloads, three via El Paso and two via Nogales. The Mexican National Railroad was hampered by lack of equipment to handle so many men at once, and delays sometimes caused the loss of considerable numbers of men already contracted, but considering the circumstances the railroad company made every effort possible to move the men expeditiously.

The result of bringing these men into California speaks for itself. Despite their utter lack of knowledge of harvesting beets, and the limits of selection imposed through the card system established, it is manifest that if these men had not been brought in and put to work, the harvest would be weeks, if not months, behind present-day deliveries. No other labor is available, so all concerned, growers and processors alike, should unite in seeing that proper treatment is accorded to these men in order that they, their Government, and F.S.A. may be satisfied, and permit the extension of the contract for another year and further importation of men for the crop of 1943.

COMPARATIVE STANDS RESULTING FROM VARYING RATES OF SHEARED SEED PLANTINGS

By W. B. MARCUM, *Agricultural Department*
Spreckels Sugar Company

During the year 1942, sheared sugar beet seed was planted at varying rates per acre in selected commercial fields, and numerous counts of stands were made in order to check the reliability of this type of seed, and to attempt to standardize the rates of planting necessary to produce the stand desired.

The following photographs show the pre-thinning stands obtained from the various rates:

Fig. 1 Fig. 2 Fig. 3 Fig. 4 Fig. 5 Fig. 6 Fig. 7 Fig. 8

Fig. 1. 1.9 lbs. per acre. This stand did not require thinning.

Fig. 2. 2.4 lbs. per acre. First hoeing and thinning were done in one operation at a cost of only $4.25 per acre.

Fig. 3. 3.6 lbs. per acre. This stand had an average of 72 per cent singles before thinning.

Fig. 4. 4.1 lbs. per acre. This stand was thinned with a long-handled hoe at a much lower cost than the majority of normal plantings.

Fig. 5. 5.4 lbs. per acre. These beets could have been thinned with a long-handled hoe or could have been cross-blocked to leave 80 per cent singles.

Fig. 6. 6.0 lbs. per acre. Cross-blocking would have reduced hand labor required for thinning.

Fig. 7. 7.1 lbs. per acre. This rate is a little too high. Only 53 per cent of the beet seedlings were one inch or more apart.

Fig. 8. 8.7 lbs. per acre. Shows bunching effect, which entails a higher thinning cost. Cross-blocking would leave approximately 50 per cent singles.

MECHANICAL BLOCKING AND THINNING

By ROY BAINER, *Associate Agricultural Engineer*
University of California at Davis
(Extract from recent paper presented by Mr. Bainer)

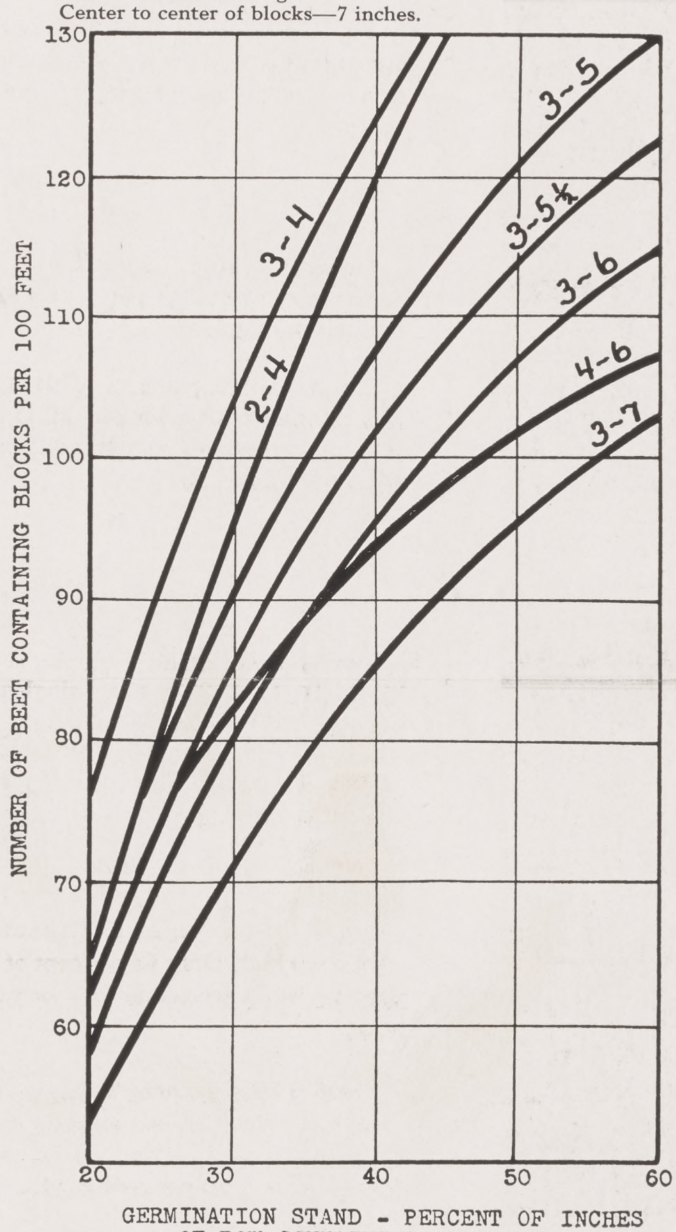
Seedling stands secured from plantings of sheared sugar beet seed may or may not permit mechanical blocking.

STAND CURVES FOR MECHANICAL BLOCKING OF SUGAR BEETS

Curves plotted from the formula developed by E. M. Mervine:

$$N = .95 \left\{ \left[1 - \left(\frac{100 - a}{100} \right)^{m} \right] \frac{1200}{n} - 3.6 \right\}$$

N = number beets in 100 ft. of row after thinning.
m = size of block in inches left by blocker.
a = % of inches of row containing seedlings.
n = number of inches center to center of blocks.
3-4 curve indicates 3-inch block remaining after 4-inch knives cut out seedlings.
Center to center of blocks—7 inches.



The deciding factor is an accurate estimation of the pre-thinned stand of plants. A relatively simple method for determining the distribution of the stand is by seedling counts made with the use of a 100-inch measuring stick. In making the counts the stick is placed beside the row and the number of inches of the measured strip containing plants are counted. For example: If seedlings are growing in 35 inches of the 100-inch strip, then the stand is designated as 35 per cent.

After the seedling stand has been obtained, data are available for using the accompanying set of curves in arriving at a setting of mechanical blocking equipment. A small safety factor of 5 per cent is allowed for losses of blocks due to the blocking and thinning operation. The numbers on each curve indicate the length of the block remaining as well as the row cut away. For example: 2-4 indicates a 2-inch block left and a 4-inch cut. The sum of the two numbers (6 in this case—which gives two blocks per foot) gives the center to center distance between blocks. It will be noticed that the number of beet-containing blocks (ordinate) is plotted against the germination or seedling stand (abscissa).

From the curve sheet it will be noted that 90 beet-containing blocks can be obtained from a seedling stand as low as 25 per cent by leaving a 3-inch block on 7-inch centers. A stand of 28 per cent would give the same number of beet-containing blocks with a 2″-4″ combination. This combination is superior to the 3″-4″ setting because of a 33⅓ per cent reduction in the size of the block; which in turn would give a higher percentage of blocks containing single plants. At the same time a slightly higher percentage of the row is cultivated out. The stand required to give 90 beet-containing blocks per 100 feet for different settings of the blocking equipment can be obtained by following horizontally across the page from 90 to the intersection of the respective curves, then dropping down to the abscissa to obtain the stands required.

CONTROLLING WEEDS BY FARM PRACTICES

By E. A. SCHWING, *Entomologist*
Northern California Beet Sugar Companies

A broad definition of a weed is a plant out of place. The farmer knows that to secure the maximum income from his farm, he must not allow a single plant to grow that does not have a definite purpose in his ranch program. That is the ideal to be attained.

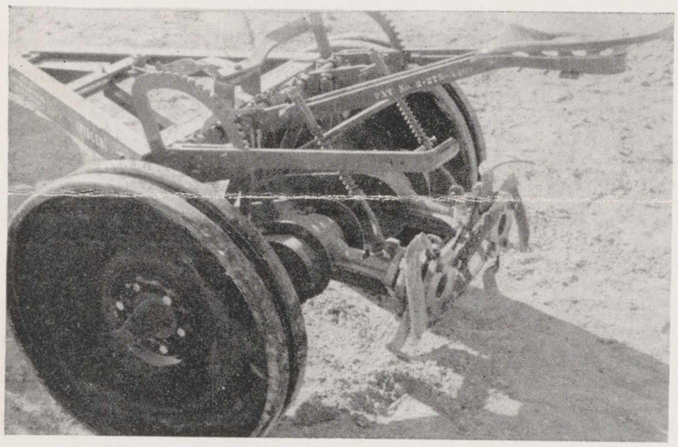
We know that weeds should be eliminated, but we also know that the cost of their removal must be considered. There is an inexpensive but effective method of attacking this problem that has already been used in a few regions, and should be expanded to include most farm areas, namely, the removal of fences along roadsides and between fields that are not used for permanent pastures, thus allowing the use of power machinery to destroy the weeds in such areas. Many of our introduced weeds obtain their first foothold along roadsides. From there the seed scatters to fence rows, irrigation ditches, and fields. By

(Continued on next page)

DIXIE THINNER (Continued from page 69)

sirable as it makes possible easy changes in pitch for operation in different types and conditions of soils.

It was found that the steel wheels were as satisfactory as the rubber-tired ones during field operation in cultivated land. The rubber was better for moving from one field to another if the machine was to be trailed. However, rubber-tired wheels cannot be obtained. The machine weighs only about 400 pounds and can be loaded easily and hauled in a pick-up truck.



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Side view, showing set of cutters to leave blocks in row.

As a final check on the newly designed beet blocker, a machine was shipped to Brawley in October for trial. Segmented sugar beet seed at the rate of 7 pounds per acre was planted on beds in the field in which the machine was used. This gave a thin, even stand with one to two-inch gaps between most plants, except on one side of the field where there were many larger gaps. With the exception of this portion, the field as a whole was a fine demonstration of stands secured from segmented seed.

Plans had been made to start on the side of the field where the stand was poor. The gaps between blades were set at 3½ inches, the distance between blocks remained at 6 inches, and the machine was started, care being exercised to keep the cutters set at a shallow cut of about 1 inch in depth. After making a round, two 100-foot lengths were checked. One had 99 blocks with 86 singles and the other had 103 blocks with 77 singles. This was quite remarkable considering the irregular stand we had to work on.

The machine was then moved to the center of the field, where the stand was more uniform. The counts there per 100 feet of row were: 117 blocks with 77 singles, 119 blocks with 68 singles, and 121 blocks with 72 singles. Thinning of all these stands could be easily completed with a long-handled hoe.

Experience with this machine shows: (1) With thin, but even, stands of beets, it is possible to block beets so that by the use of long-handled hoes very satisfactory thinned stands can be secured; (2) To secure best results, the depth of cut should be shallow, that is, approximately 1 inch; (3) To secure the best results with the machine, the surface of the land must be as uniform as possible. Particular care should be exercised in forming beds of uniform height if the beets are to be planted in this manner.

WEEDS (Continued from page 73)

stopping the weeds at the primary source, a great deal of future weed destruction could be eliminated.

Effective weed control is closely related to good agriculture. There should be no weed-producing waste land. Ditches should be kept clean. As much hand labor as possible must be eliminated and this can best be done under such conditions as previously mentioned. Annual weeds are easily kept down by clean culture. Areas containing perennial weeds should be frequently inspected and the perennials are controlled best by immediate destruction as they appear. Once established, they are difficult to eradicate.

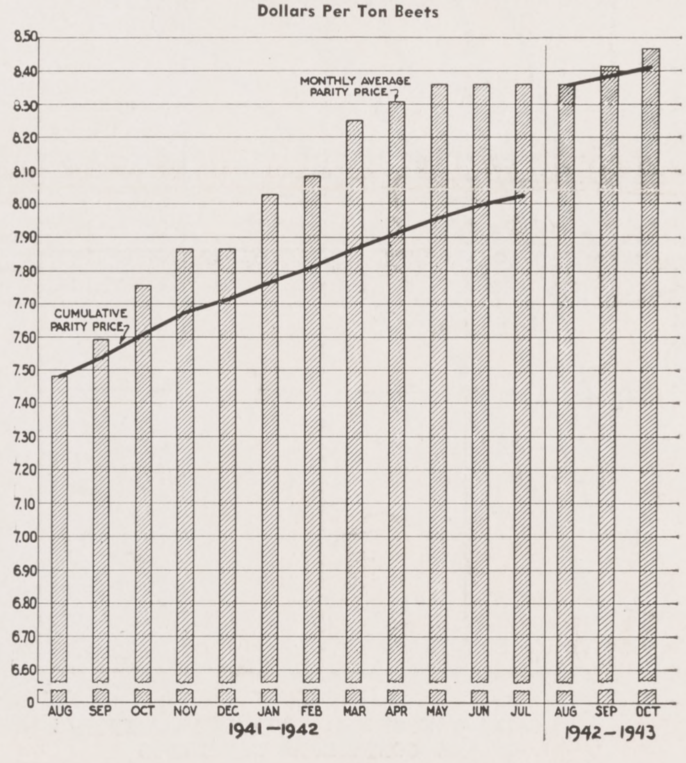
Weed control pays dividends. Russian Thistle in the California valleys fosters the development of the beet leaf hopper (Eutettix tenellus) and the virus disease that is transmitted to sugar beets, tomatoes, melons, and other crops. Its pollen is a major cause of hay fever. Wild lettuce harbors and develops thrips. Malva carries rust that attacks many crops. Scale insects are carried on weeds. Some weeds support and develop nematodes, while the role of weeds in developing Sclerotium is well known. There are many other destructive insects such as army worm and aphis living on weeds in undisturbed waste farm areas.

We are all agreed that weeds should go. We are also agreed that expense must be considered. By following good farming practices, and by removing unnecessary fences and ditches so these and other waste areas can be cultivated, we can control many of our weeds at a minimum cost.

OCTOBER PARITY PRICE OF SUGAR BEETS—$8.47

(PARITY BASE — 1909-1914 = $5.50 PER TON BEETS)

Dollars Per Ton Beets



Spreckels SUGAR BEET Bulletin

PUBLISHED FOR CALIFORNIA SUGAR BEET GROWERS BY THE SPRECKELS SUGAR COMPANY

1942

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(Continued on reverse side)

SPRECKELS SUGAR COMPANY SCHEDULE OF BEET PAYMENTS

DOLLARS PER TON — 1942 CROP

Average Net Selling Price for Sugar Per Pound (cents)	12%	13%	14%	15%	16%	17%	18%	19%	20%	21%
	PER CENT SUGAR IN BEETS									
3.75	3.7800	4.1600	4.5500	4.9500	5.3600	5.7800	6.2100	6.6500	7.1000	7.5600
3.76	3.7920	4.1728	4.5640	4.9648	5.3760	5.7968	6.2280	6.6688	7.1200	7.5808
3.77	3.8040	4.1856	4.5780	4.9796	5.3920	5.8136	6.2460	6.6876	7.1400	7.6016
3.78	3.8160	4.1984	4.5920	4.9944	5.4080	5.8304	6.2640	6.7064	7.1600	7.6224
3.79	3.8280	4.2112	4.6060	5.0092	5.4240	5.8472	6.2820	6.7252	7.1800	7.6432
3.80	3.8400	4.2240	4.6200	5.0240	5.4400	5.8640	6.3000	6.7440	7.2000	7.6640
3.81	3.8520	4.2368	4.6340	5.0388	5.4560	5.8808	6.3180	6.7628	7.2200	7.6848
3.82	3.8640	4.2496	4.6480	5.0536	5.4720	5.8976	6.3360	6.7816	7.2400	7.7056
3.83	3.8760	4.2624	4.6620	5.0684	5.4880	5.9144	6.3540	6.8004	7.2600	7.7264
3.84	3.8880	4.2752	4.6760	5.0832	5.5040	5.9312	6.3720	6.8192	7.2800	7.7472
3.85	3.9000	4.2880	4.6900	5.0980	5.5200	5.9480	6.3900	6.8380	7.3000	7.7680
3.86	3.9120	4.3008	4.7040	5.1128	5.5360	5.9648	6.4080	6.8568	7.3200	7.7888
3.87	3.9240	4.3136	4.7180	5.1276	5.5520	5.9816	6.4260	6.8756	7.3400	7.8096
3.88	3.9360	4.3264	4.7320	5.1424	5.5680	5.9984	6.4440	6.8944	7.3600	7.8304
3.89	3.9480	4.3392	4.7460	5.1572	5.5840	6.0152	6.4620	6.9132	7.3800	7.8512
3.90	3.9600	4.3520	4.7600	5.1720	5.6000	6.0320	6.4800	6.9320	7.4000	7.8720
3.91	3.9720	4.3648	4.7740	5.1868	5.6160	6.0488	6.4980	6.9508	7.4200	7.8928
3.92	3.9840	4.3776	4.7880	5.2016	5.6320	6.0656	6.5160	6.9696	7.4400	7.9136
3.93	3.9960	4.3904	4.8020	5.2164	5.6480	6.0824	6.5340	6.9884	7.4600	7.9344
3.94	4.0080	4.4032	4.8160	5.2312	5.6640	6.0992	6.5520	7.0072	7.4800	7.9552
3.95	4.0200	4.4160	4.8300	5.2460	5.6800	6.1160	6.5700	7.0260	7.5000	7.9760
3.96	4.0320	4.4288	4.8440	5.2608	5.6960	6.1328	6.5880	7.0448	7.5200	7.9968
3.97	4.0440	4.4416	4.8580	5.2756	5.7120	6.1496	6.6060	7.0636	7.5400	8.0176
3.98	4.0560	4.4544	4.8720	5.2904	5.7280	6.1664	6.6240	7.0824	7.5600	8.0384
3.99	4.0680	4.4672	4.8860	5.3052	5.7440	6.1832	6.6420	7.1012	7.5800	8.0592
4.00	4.0800	4.4800	4.9000	5.3200	5.7600	6.2000	6.6600	7.1200	7.6000	8.0800

The above schedule is the same as that printed on your 1942 beet contract except that it includes payments at 1/100 cent intervals for net selling prices between 4¢ and the guaranteed minimum of 3¾¢, and for sugar contents from 12% to 21% sugar in beets.

Payments for sugar percentages between those shown can be determined by a few short steps as explained below. (Prices as shown in this schedule do *not* include the Company's loading allowance of 15¢ per ton and the hauling allowance of 2½¢ per ton per mile nor the Government's benefit payments.)

EXAMPLE

Determine the price per ton of beets testing 17.62% sugar at 3.77¢ net selling price.

3.77¢ N.S.P. @ 18% sugar	=	$6.2460 per ton
" " " 17% sugar	=	5.8136 " "
Difference	=	$ .4324 per ton
$.4324 × .62	=	$ .268088
3.77¢ N.S.P. @ 17% sugar	=	$5.813600
Payment for .62% sugar	=	+.268088
Total payment per ton @ 17.62% sugar	=	$6.081688

CROP RECORD — 1942

FIELD No. OR NAME	ACRES PLANTED	ACRES THINNED	ACRES HARVESTED	TONS PER ACRE	SUGAR PER CENT	ESTIMATED PAYMENT N.S.P.	ADDITIONAL PAYMENTS